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CONVENTION OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The thirty-second annual convention of the American Institute of Electrical Engineers, which was held at Deer Park, Md., last week, added another to the long list of felicitous gatherings of that organization. This convention was a decided success and added one more argument to the growing sentiment in favor of holding conventions at summer resorts. The attendance at such points is, of course, never so great as at conventions which are held in the large cities. The latter bring together a large registration of local members which swells the records of attendance and gives opportunity for a large number to take some part in the activities who would not otherwise participate. It is to be noted, however, that the actual attendance at the sessions is little, if any, larger in the city conventions than at the summer resort. At the latter place there are not the distractions which are encountered in the large city and the members are kept closer together. The attendance at the sessions reflects this influence.

The discussion at the sessions of the convention this year was probably above the average in quality and fullness. Perhaps this was due to the excellent work of the Papers Committee, which succeeded in rounding up most of the papers well in advance, and members had the opportunity of going over the printed copies in the *Proceedings* well ahead of the convention.

Unfortunately the weather at Deer Park was not as propitious as might have been desired and interfered somewhat with the games which were planned to add a little recreation to the more serious work of the convention. Weather conditions form one of the elements of a convention which, with all our modern science, we are not yet able to accurately forecast, and, consequently, have to be satisfied to take on chance. The golf enthusiasts, however, were not deterred from wielding their sticks and another name was added to the Mershon cup. The baseball game fell upon a clear day and the spectators witnessed one of the best contests among the many that have been played at the Institute conventions.

As usual certain sessions of the convention were devoted to particular subjects arranged under the auspices of certain of the Institute committees. A departure from the usual practice was evidenced, however, in confining the papers to a very small portion of the subject coming under the scope of the committee. Thus, the papers dealing with railway

problems were confined to a discussion of contact systems, while the special subject considered in connection with transmission lines was the foundations for towers. This policy, which promises well as a definite one for future practice, enables the subjects to be gone into in much more detail than would otherwise be the case, and permits the assemblage of the opinions of a number of specialists in the chosen line. A volume of opinions and data is thus acquired which probably cannot be brought together in any other way. This policy is consequently to be highly commended.

It is a little difficult to pick out from the two dozen or more papers presented at the convention any particular one as being of prime importance, as there were a number which elicited an unusual amount of interest. Among these was a discussion provoked at the opening session by the papers on "Irregular Wave Forms" presented by Prof. Frederick Bedell and his co-workers. The appreciation of the advantages of using an electric wave having the sine shape; that is, one in which the fundamental frequency is not accompanied by any higher harmonics, has been steadily growing in recent years. It has been fully recognized that the method provided in the Standardization Rules for determining the departure of any given wave from the standard sine, is not all that can be desired. This method is to measure the difference in ordinates between the wave and the equivalent sine wave, and express the maximum difference in terms of the latter. There are various factors which serve to express the amount of distortion in a given wave and each of these is useful for some particular purpose, but none has been proposed which expresses distortion in a quantitative way equally well for all purposes. It seems evident that no measure of this kind can be adopted which will suit everybody. Thus, the telephone interests find distorted waves on power lines objectionable on account of the inductive interference which is created in the neighboring telephone lines, and the measure of this objectionableness should be in terms of the amount of noise created. In this regard those harmonics of frequencies most nearly approximating that of the average human voice, to which the sensitiveness of the receiving apparatus has been adjusted, are most objectionable. The differential distortion-factor, which weights the amplitude of such harmonics in proportion to their frequencies, does not weight them heavily enough to meet this consideration.

It would consequently seem as if the allowable departure from a sine wave which is to be tolerated in any particular case should be specified in such a way as to most severely penalize those harmonics which are most objectionable under the given circumstances, rather than to attempt to frame a single rule which shall limit this departure in all cases. Some compromise, however, such as is represented by the differential distortion-factor would seem preferable to the present Institute rule.

ELECTRIC RATES.

The convention paper of Mr. Frank G. Baum proposes a system of rates which shall recognize the various classes of consumer now customary, but which shall make the charges for electric energy the same within the same class over large areas of territory regardless of whether such territory is served by a single company or by a number of them. Mr. Baum does not believe in following too closely the cost of service in determining rates. It is generally recognized that the basis of cost cannot be followed out to the extreme of determining costs exactly for each individual consumer or even for each class of consumer. Rates, too, are usually the same throughout a municipality or other geographical division served by a single company. They are not, however, at the present time always made the same in the different communities served by one corporation when transmission or other costs are different for the different communities. We are not prepared to agree with Mr. Baum that these should be the same, and indeed he himself admits that communities enjoying underground distribution should not receive service at the same rate applying to one which has overhead lines.

It is generally recognized that rates should be made up of elements depending upon the energy consumption and upon the maximum demand, at least so far as these refer to groups of customers in different classes. Mr. Baum shows the method of applying this principle to the different classes in a way to determine a price per kilowatt-hour which shall include the class load-factors, and perhaps the greatest value of this paper is in working out the details of this method of adjusting rates. One of the principal advantages claimed by Mr. Baum for his proposal is that the company which operates its system efficiently will be rewarded, whereas inefficient operation will be penalized. One of the objections to the ordinary methods of government regulation, in which income is equalized too closely to costs, is that incentive to good management and efficient operation is to some extent removed. We do not feel confident, however, that Mr. Baum's scheme will realize all the advantages which he claims for it, as costs of service depend in many cases upon natural advantages and disadvantages as well as upon skill and efficiency in management.

However, there is much to be said in favor of the proposal, although questions will naturally arise as to its application. The extent of territory over which rates would be made uniform is an important question and one regarding which there would no doubt be much difference of opinion. In many cases, no doubt, this territory would be restricted to units as small as those already existing. With regard to the classification of customers it is to be noted that no classification is made for residence loads other than lighting. It must be recognized that if domestic heating and cooking are to be developed they must be accorded all advantages in rates to which their load-factors and diversity-factors entitle them.

DIELECTRIC LOSSES.

One of the most interesting and valuable papers presented at the convention was that dealing with the examination of insulating materials by the use of the cathode-ray tube. This paper was presented by Mr. John P. Minton and represented the results of several years of work in perfecting the apparatus and carrying out the tests which were described. The great difficulty in measuring dielectric losses upon specimens of convenient size is that a small amount of energy must be measured under a condition of high voltage. This presents difficulties which are not conveniently met by ordinary measuring instruments. The cathode-ray tube, however, after its operating difficulties were overcome, proved a very suitable means for carrying out measurements of this kind. In using this tube the cathode rays are deflected by two electric fields, one of which is proportional to the voltage applied to the insulating material being tested, and the other proportional to the current which flows in the dielectric. As these two fields are at right angles, the cathode rays impinging upon a fluorescent screen describe an ellipse whose area is proportional to the amount of energy expended. This arrangement of the apparatus has been given the name of cyclograph.

This paper is valuable for two main reasons. One lies in the perfection of the technique of operating cathode-ray tubes, and the other lies in the results obtained with particular materials, not merely on account of the measured constants, but on account of showing the manner in which the energy loss varies with voltage, temperature, etc. Results were given for varnished cloth and oil-treated pressboard, the latter containing varying percentages of moisture. In both of these substances the energy loss was found to increase with the temperature, going up rather rapidly after the boiling point of water is reached. This is quite different from the behavior of gutta percha, which was referred to in these columns two weeks ago. It might be supposed that the energy losses would increase in proportion to the square of the voltage, as would be the case in an ordinary conducting material. This, however, is not borne out, probably for the reason that the energy expended is not merely due to leakage or conduction currents. In some cases the current which flows is not proportional to the voltage and even where it is, the power-factor will vary in such a way as to prevent the energy or power from being proportional to the square of the voltage. Ohm's law, which holds so generally in metallic conductors, is not always followed in insulating materials and this is particularly true in such as contain absorbed moisture. In such substances the current should increase more rapidly than the voltage, and this will naturally cause the power to increase more rapidly than as the square of the voltage. In some of the substances tested, however, the ratio of increase has been at a lesser rate than the square of the voltage. This comes about through a decreasing power-factor.

It is to be hoped that this method, which shows such great possibilities for investigation along this line, will be applied to a large variety of insulating materials, a more complete knowledge of which is greatly needed, especially by the designer of electrical apparatus.

ELECTRIC COOKING.

A considerable number of data have been published from time to time giving the cost and energy consumption involved in electric cooking for families of different sizes. In many cases this information has been in such form as to give only a rough idea of the figures which would apply in a different case, as details vary a great deal so far as the requirements of different families are concerned and conditions of operation are involved.

One of the papers at the convention of the American Institute of Electrical Engineers gave the results of some much needed tests upon the energy consumed and consequently the cost when various cooking operations are carried out under somewhat different conditions. Mr. Percy W. Gumaer has investigated the variation of energy consumption with the temperature at which cooking is done and the consequent variation in time necessary to complete the process. Several typical varieties of food were experimented with, such as roast beef, biscuits and sponge cake, for which the requirements were quite different. Different temperatures are necessary for the best results with different articles of food, and while cooks know in a general way the degree of heat necessary to get good results, it is very seldom that they are informed as to the most economical temperature of cooking. Since the loss of heat from a range will be greater the higher the temperature, it is most economical to cook at the lowest temperature at which good results can be obtained. This temperature will depend upon the particular article of food involved. Thus, while biscuits require a temperature of at least 200 degrees centigrade, beef can be satisfactorily roasted at 100 to 120 degrees, and vegetables also can be better handled at a low temperature. The time necessary to cook most articles varies inversely with the temperature, but in general the low temperature will give the most economical rate of cooking. Individual results should be consulted, however, before making any general conclusions in this connection.

Mr. Gumaer concludes that the art of cooking with electricity can be reduced to an exact science if the necessary investigation is made, and it is our purpose here to call attention to the value of these experiments and the necessity of further work along the same line in order that users of the electric oven may be informed as to how to most economically operate the apparatus. When such information is generally available, the electric stove will come into much more general use than has hitherto been the case.

United States Light and Heating Company Sold.

The assets of the United States Light and Heating Company have been sold in Buffalo, in compliance with the order of the United States District Court for the Western District of New York, to the purchasing committee, which is made up of practically the same interests as the stockholders protective committee. The order of the court specified that the amount at which the properties were to be taken over should be sufficient to pay off all obligations excepting obligations for patent infringements. The amount of the debts and expenses of the receivership was given at $860,000, the company having been operated by the receivers since July 13, 1914.

A motion was brought before the court on June 30 by the Safety Car Heating and Lighting Company to postpone the sale on the ground of infringement of patent rights owned by the Safety company, the validity of which had been upheld by the Court of Appeals recently. The District Court permitted the sale to proceed with the understanding that it be subject to this claim, which is to be paid as soon as the amount can be determined by a special master, who will be appointed for that purpose.

Under the order of the court the receivership is now terminated and the reorganization of the stockholders' committee will become effective and the operation of the company continued under the new management.

Convention of Telephone Pioneers.

The fifth annual meeting of the Telephone Pioneers of America will be held at San Francisco, Cal., September 21 to 23.

The Transportation Committee has arranged a special train for members and friends who attend the convention. This train will have exclusive Pullman equipment and will cover a tour of 23 days with all expenses included in the ticket. The train will start from New York City at 12:50 p. m. on Tuesday, September 14, and proceed by the New York Central Railroad to Chicago. Connections will be made from Boston, Pittsburgh, and other points. The train will leave Chicago at 11:50 a. m. on September 15 and the going route will include Omaha, Denver, Colorado Springs, and Salt Lake City, stops being made of a half day each in Denver and Colorado Springs. A day will be spent at Salt Lake City. The train will arrive at San Francisco on the evening of September 20.

The train will leave San Francisco on the morning of September 26 and proceed to San Diego, stops being made at Del Monte, Santa Barbara, and Los Angeles. Thursday, September 30, will be spent at San Diego, the return trip commencing at 2:00 a. m. on Friday, October 1. The Grand Canyon in Arizona will be visited and stops made at Kansas City and Chicago. The train will reach New York at 5:25 p. m. on Wednesday, October 6.

The total distance covered by this tour will be 7,746 miles. The expense from New York is from $202.60 to $263.05, depending upon the train accommodations desired.

If desired, the return trip may be made by other routes, using the direct line from Los Angeles to Salt Lake City or taking the northern route through Portland, Seattle and Minneapolis.

Electrical Progress at Leeds.

The electrical engineer of the city of Leeds, England, refers in his annual report to the continued growth in the popularity of electricity for private lighting purposes. The number of units sold was 11.1 per cent greater than in the preceding year, and the income 10.7 per cent better. As an illustration of the effect of the invention and adoption of more economical lamps aided by a fall in the price of current, it is mentioned that the income from sales of energy for private lighting is even now $15,325 smaller than it was in the year 1907-1908, although the number of such consumers has in the meantime grown from 5,504 to 10,759. In the power and heating department at Leeds last year there was again a great increase of business, the horsepower of motors connected up advancing by 15.9 per cent and the heating apparatus by 54.7 per cent; the units sold advanced by 16.4 per cent and the revenue by 14.2 per cent. Working expenses per unit sold fell from 0.84 cent to 0.76 cent. The profits at $121,120 were the biggest ever made by the undertaking.

Report on Electrical Vehicles at Birmingham.

James Jackson, superintendent of the refuse disposal department of the City of Birmingham, England, has reported to the city authorities on the experiments made there with electric vehicles. Two of these vehicles belonging to the electric supply department are hired out to the refuse department upon agreed terms, the object being to demonstrate to users of haulage vehicles their suitability for town work. These two electrics are replacing four horses drawing four-wheeled wagons, and one reserve horse, and they collect house refuse from portable ashbins. Three trials have all demonstrated that one electric can usefully replace two horses, and Mr. Jackson gives the following reasons as fully justifying an extended trial:

(1) The cost appears to justify an extended trial.

(2) In Birmingham there are 275 horses engaged in connection with refuse disposal work and if electrics were adopted the number would be reduced by one-half.

(3) All the refuse removed has to pass over a weighing machine so that the clerical labor would also be reduced to the same extent.

(4) The supervision by outside inspectors of half the number of vehicles should be either less expensively or more effectively performed.

(5) The expense of accidents resulting from horses getting out of control and moving on while the driver is at rear of premises, would be avoided.

(6) The litterings of streets with horse manure and the consequent expense of cleaning same would be considerably reduced while the improvements and benefits resulting in tidier streets, especially in areas where the dwellings of the poor are close to the roadway, would undoubtedly assist in a reduction of "filth" diseases.

(7) The electric vehicle can be lighted with metal-filament glow lamps by current contained in the storage battery and the superior light thus obtained would materially reduce the number of accidents which now occur in many cases through the badly lighted horse-drawn vehicles.

Two Mossay electrics ordered by Birmingham are to have ironclad Exide batteries and Mr. Jackson makes reference to the extensive use of this type in America. "They are as regards performance about half way between the ordinary lead battery and the Edison battery, and the advantage of them is that they can be charged at a constant voltage with a tapering current and consequently require no regulation and no attention when on charge, as is the case with the ordinary lead battery."

The Birmingham electric supply committee has decided to maintain the batteries in order to ascertain exactly the cost of upkeep; a reliable figure should be obtained at the end of two years, and the sinking fund to be set aside is estimated to be sufficient to renew the batteries. A cost system for all work in the refuse disposal department is in operation and a fair trial will be given to the electric to demonstrate its superiority over the horse.

Electric Club-Jovian League.

The last meeting of the Electric Club-Jovian League of Chicago, before the summer recess, was held on July 1, at which Charles S. Deneen, former governor of Illinois, delivered a stirring address on "Americanism." A. A. Gray introduced the speaker.

The picnic committee, headed by H. A. Mott, reported progress on arrangements for the event, which will be held at Ravinia Park on August 5. C. W. Forbrich, 608 South Dearborn Street, has charge of ticket disbursements.

Samuel A. Freshney.

The requirements of the ideal manager of a large public utility are not easily fulfilled. On account of the many-sided interests of modern utility service he must be a man of not only broad technical and practical experience, but also of known sympathy with matters promoting the community and general public welfare. Such a man, if endowed with the trait of leadership, makes also an ideal head for an organization of utility interests.

These requirements were happily recognized last week in the election to the presidency of the Michigan Section, National Electrical Light Association, of Samuel A. Freshney. For over thirty years he has been closely identified with many branches of the electrical industry. Starting in 1884, when the industry was still in its infancy, he was connected with the old Brush Electric Company, of Cleveland, Ohio, one of the pioneer electrical manufacturers. He was employed in various electrical and mechanical departments of this historic firm, gathering a wealth of experience during the early development of arc lamps, arc-lighting generators, storage batteries and other electrical apparatus. Mr. Freshney can narrate many interesting anecdotes of those early days when the factory representative was called upon to exercise his ingenuity in selecting appropriate station and line equipment, install it and operate the plant until local operators could be trained to handle the apparatus.

After seven years' connection with the Brush organization, Mr. Freshney came to Muskegon, Mich., becoming manager of the Muskegon Electric Light & Power Company, whose plant he developed to a high state of efficiency. In 1900 he again associated himself with an electrical manufacturer, serving for two years as special sales engineer for the Fort Wayne Electric Works, Fort Wayne, Ind. In 1902 he returned to Muskegon to take the position of general manager of the Muskegon Traction & Lighting Company, which he held for three years.

The city of Grand Rapids, Mich., called for Mr. Freshney in 1905, when he was appointed secretary and general manager of the Grand Rapids Board of Public Works. He was particularly engaged in the management of the municipal electric light plant, which he built up to be one of the best handled public undertakings of the kind at that time. After seven years' service in the public interest he became associated for four months in 1912 with the Electric Bond & Share Company, of New York City.

On September 1, 1912, he was appointed general manager of the Grand Rapids-Muskegon Power Company, which position he has held to date; he is also general manager of the affiliated Grand Rapids Edison Company, the former supplying alternating current and the latter direct current. The Grand Rapids-Muskegon Power Company is noted for having been the first one to transmit hydroelectric energy at 110,000 volts and subsequently the first to raise this line voltage to 135,000 and even 140,000 volts. His long experience in so many branches of the electrical industry, his close acquaintance with both Grand Rapids and Muskegon from long residence and service in each, and his genial personal qualities make Mr. Freshney an admirable and highly esteemed incumbent in his present position.

Samuel A. Freshney,
President-elect, Michigan Section, National Electric Light Association.

Mr. Freshney is a member of the American Society of Mechanical Engineers, a life member of the National Association of Stationary Engineers, and a member of the National Electric Light Association.

Electric Motors on Dutch Farms.

"The idea of electric motors for general service in small industries and on farms," says Commercial Attache Erwin W. Thompson, The Hague, "is usually associated with cheap water power for generating the electricity. Cheap sources of power have been principally responsible for popularizing the use of small motors.

"Small motors having once been introduced soon demonstrated their advantages and conveniences and became increasingly popular. This demand has stimulated the electrician to further perfect the machinery for generating, distributing and applying the electricity and making it less difficult to control. The success of this work has reacted by extending the uses of the small motor among people having but little technical knowledge and skill.

"Coincident with electric improvements has come a great advance in the efficiency of steam-power machinery, especially for large units, and these have co-operated to greatly extend the use of small motors, even in districts where there is no water power. This development is becoming important in the Netherlands and is specially notable on the farms for such intermittent work as threshing, home grinding, feed cutting and churning. The country is thickly populated. the farms are small and intensive, and every possible acre is cultivated. Here is a set of conditions conducive to the establishment of a central power station. Here, where one is never out of sight of the drainage or navigation canal, with unlimited water all the year round, the problem of good feed water for boilers and cool condensation water for engines is solved and the question of high fuel cost is much counterbalanced.

"War conditions have much increased the cost of fuel because of the reduction of the imports of coal from Germany and England. The price of gasoline (used for small engines) has advanced in a greater degree than coal because of difficulties of importation, and because of the increased use of automobiles by the army; but these same conditions affect the cost of all power, great and small, and do not militate against the use of electricity, which, after all, is not a primary source of power, but only a convenient means of distribution.

"Germany previously furnished most of the electrical machinery and a large proportion of the steam engines and boilers used in the Netherlands. This source of supply is now practically unavailable and the field is inviting for American enterprise."

Electric Iron-Ore Smelting in Norway.

In Sweden the adoption of electric furnaces for the reduction of iron ore is apparently spreading, and the results obtained are encouraging, and likely to lead to further developments in this direction.

In Norway matters have not progressed quite so smoothly, owing to the different conditions prevailing in the two countries. In Sweden charcoal is used as the means of reduction, but in Norway charcoal is too expensive, and unless coke can be used the process cannot be worked with advantage, in spite of Norway's wealth of water power. The first attempt with coke at the Hardanger works proved so little encouraging that the whole works eventually stopped, although the ores used were rich in iron.

At Tinfos, however, the very opposite experience has been encountered. A regular and remunerative manufacture of electric iron has now been going on for some time, and the production for the present year is estimated at 10,000 tons of electric pig iron. This satisfactory result is all the more noteworthy inasmuch as the ores used are rather poor so far as their percentage of iron goes, but otherwise what may be called good ore, hailing from three mines—Klodeberg, Grevinde Wedel, and Fon Anker—averaging some 45 per cent of magnetic iron ore.

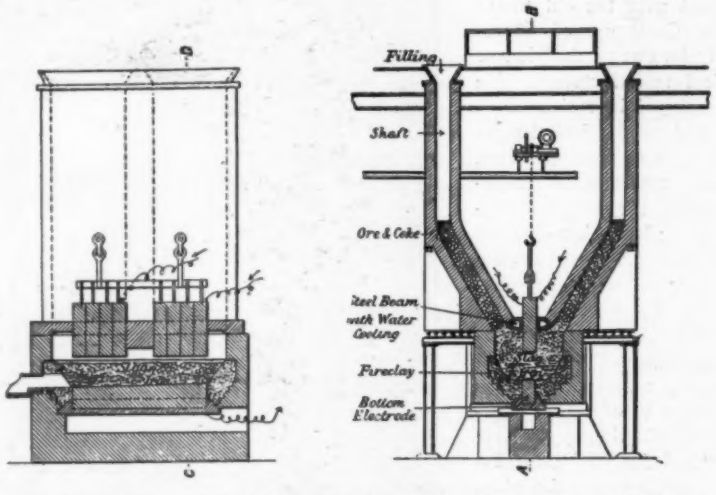
The illustrations show the Tinfos electric furnace as used in the first three furnaces. It differs from the Swedish furnace used at Trollhättan by having a shaft on each side, so that the ore is led on to the two square electrodes. The upper electrodes each consist of three of four smaller electrodes. The electric current proceeds from the electrodes through the charge, the slag, and the liquid pig iron, down to the bottom electrode. This furnace, consequently, differs from the Swedish furnace, not only in having a bottom electrode, but, also, it has no gas circulation and requires very little water for cooling purposes. The fourth furnace differs from the three others by having three heavy round electrodes, with nipples. The question of a furnace with but one shaft is by no means excluded.

The charge consists of iron ore, coke, and, according to circumstances, limestone, the quantity of which depends upon the nature and blending of the ore, the quality of the coke, and the quality of pig iron wanted. Charcoal, as already mentioned, is not used.

Patient experiment in different directions, and not always under the most favorable conditions, has led to the production of pig of high quality, strong and comparatively tough. Even at an early stage of the experiments it could be ascertained that the iron produced promised exceedingly well, thanks to certain good qualities in the ores which have been used.

When coke is used, the shafts of the furnace need not be very high, and, as a rule, the charge does not reach higher than a little beyond the bend in the shaft. The upper part of the shaft serves as a chimney, which produces the necessary draft in the furnace. To fill the shafts any higher with ore than shown in the illustration is not to be recommended when the ore contains zinc.

The Tinfos electric pig iron is close, being produced electrically, without any air being blown into the furnace. This pig can thus with advantage be used for all kinds of foundry goods which require much strength, such as cylinders, presses, pumps, propellers, etc., and it can with advantage be added to ordinary cheap and less strong pig, used in the foundries with or without addition of ferro-silicon.



Sectional Views of the Tinfos Electric Furnace for Iron-Ore Smelting.

The cost of production, including ore, coke, limestone, and electrodes, besides wages, crushing, weighing, and transport of materials, mounting of electrodes, repairs, storage of iron, the laboratory and electric energy, can, according to what so far has been experienced, be kept at from $17.75 to $18.35 per ton of pig iron when all three furnaces are kept going, exclusive of management, sinking fund, interest and taxes.

From the beginning of the present year all four furnaces have been worked regularly, one being always kept in reserve. Each furnace produces about 9 tons per day, or 27 tons for the three, making some 10,000 tons per annum. The percentage of pig iron from the ore varies from 44 to 47 per cent according to the quality of the ore. The power in the furnace may be as much as 1,200 kilowatts to 1,400 kilowatts.—*Engineering.*

English Electric Vehicle Committee.

At the meeting of this committee, held on June 11 in London, R. A. Chattock presiding, very satisfactory sales of the third number of the committee's organ, *The Electric Vehicle*, were reported.

Moreover, the special committee of the Local Government Board on Motor Traffic is being asked to hear evidence by the secretary on the effect of the use of electric vehicles. Everything is to be gained by bringing the actual facts of the case for electrics home to the mind of this particular government department which has it in its power to assist the municipal service branch of motor-vehicle business. Representative electrical institutions in the British colonies are being approached with the suggestion that they adopt the English committee's standards in regard to electric vehicles.

Examination for Apprentice Electrical Engineers.

The United States Civil Service Commission has announced an open competitive examination for apprentice electrical engineer to be held on August 4 at the usual places to fill vacancies in the Bureau of Mines at Pittsburgh, Pa., at salaries ranging from $720 to $960 per year and other vacancies as they may occur. The duties of this position will be to assist in experiments with electrical apparatus used in mining.

Competitors will be examined on electrical engineering, which will determine 70 per cent of their rating, the other 30 per cent being based upon education and experience. Graduation from a four-year course in electrical engineering is a necessary qualification. Applicants should secure Form 1312 from the United States Civil Service Commission, Washington, D. C.

Electricity in Ice-Cream Manufacturing.

The introduction of the motor-driven brine-cooled ice-cream freezer has practically revolutionized ice-cream making by eliminating excessive waste of ice and salt. The business from the central-station standpoint is particularly desirable, because of high load-factor and off-peak characteristics. This article discusses the processes of manufacture with relation to motor drive.

When it is considered that the annual consumption of ice cream in this country is about five quarts per capita, with a continual increasing demand, some idea of the extent of this industry and the extent of the field for central-station service may be had. Many ice-cream manufacturers have already modernized their establishments by the substitution of motor-driven refrigeration and mixers for the old wasteful methods, and practically all new plants convenient to central-station service are electrically driven, but there is still an appreciable number of smaller shops, such as combination ice cream and bakery, etc., which remain to be converted.

Group of Ice-Cream Mixers in Chicago Factory Driven by 20-Horsepower Motor.

Under the old conditions freezing was done with a mixture of ice and salt, usually about 1.5 tons of ice and 800 pounds of salt being required for every 100 gallons of ice cream frozen. In addition to this method being slow, and objectionable from the standpoint of cleanliness it was extremely wasteful because of the rapidity with which the ice melts and because of the fact that it is impossible to reclaim the salt.

In the modern ice-cream factory artificial refrigeration is used exclusively, motor-driven refrigerating machines being found entirely satisfactory. The most striking advantages of central-station service in this industry are lower investment for apparatus, lessened space required, absence of heat from the building, lessened chance of a breakdown, flexibility of operation and lower cost of operation.

The ice-cream industry is a very desirable load for the central station, since its daily load-factor is high, the period of greatest demand occurs in the summer months, and, as a rule, the business may be taken on off-peak schedules. The maximum load with reference to connected load is very high, as sometimes the total equipment, with the exception of the elevators, is operating at full load; the ratio of the half-hour demand to the connected load varying from 40 to 60 per cent.

The kilowatt-hours used per unit of product vary from 0.5 to 1.5 per gallon of ice cream, depending upon whether the plant buys ice or makes its own, and also upon the economy of operation.

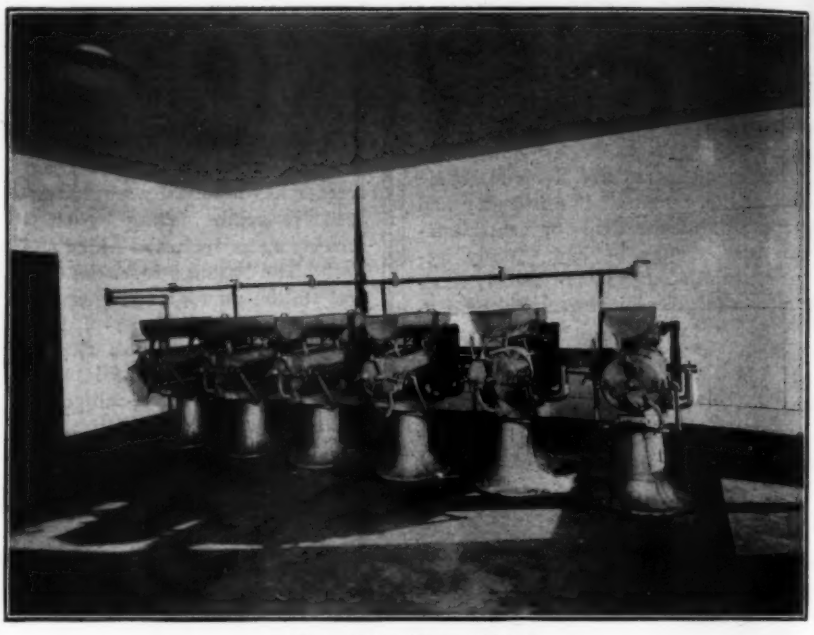
The essential operations in the ice-cream industry are the receipt of the cream and milk, its pasteurization, cooling and storing. Afterwards the cream and milk, mixed in correct proportions, are sent to the mixers or freezers. When the mixing is completed the ice cream has a soft consistency such that it will flow and take the shape of its container. It is then set aside to hard-

en and be cooled to about 8 or 10 degrees.

There are two methods in general use for hardening ice cream, the dry hardening system and by the use of a brine tank. In the former the cans of freshly made ice cream are set on racks or shelves in a room or refrigerator box in which cold air is circulated by means of fans. Occasionally the racks are formed of the cooling pipes themselves, but usually all the ammonia piping is in a loft or bunker and the air passed and repassed over it until at a very low temperature. As this circulates about the cans of ice cream they are rapidly cooled and the ice cream hardened in from four to eight hours. Because of the rapidity of the cooling this method is being generally adopted by the wholesale manufacturers, but is not well adapted to the retailer on account of the increased room and high cost.

In the brine-tank system the cooling pipes are immersed in brine contained in what is termed the hardening cabinet. This brine is generally still, and is maintained at a temperature approximately zero. The cabinet contains usually either a perforated false top or a series of perforated cylinders, into which the cans holding the freshly made ice cream are placed. They are thus surrounded by cold brine and the hardening effected usually in from 6 to 10 hours.

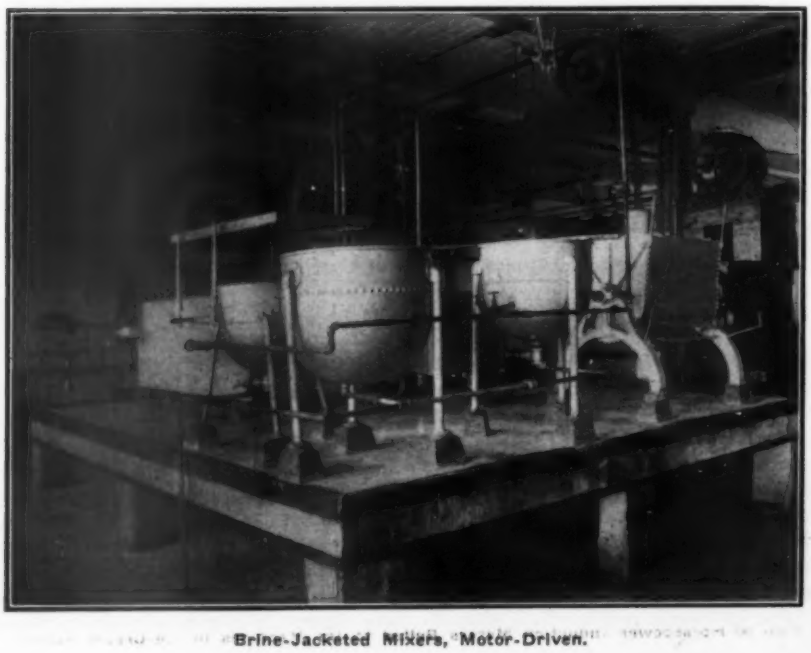
Practically all of the brine ice-cream freezers in use today are adaptations of the one principle of a jacketed can with a revolving paddle. Cold brine flows through the jacket and the ice-cream mixture is cooled in the inner compartment until it is viscous and just capable of flowing into the containers for hardening. Frequently the ice cream is placed for hardening into the cans intended for delivery, as the manufacturers claim that there is a noticeable shrinkage when ice cream is repacked.



Battery of Ice-Cream Mixers.

Each gallon of ice cream requires in the refrigeration machine a capacity equal to 800 British thermal units for the making and hardening. This heat is not all extracted from the ice cream, but allows for leakage and losses. If the ice cream is then to be kept for several days before being sold additional provision must be made.

While ice-cream manufacturing is now conducted almost entirely without the use of ice there is still a heavy demand for ice for packing and shipping and the large companies all manufacture this.

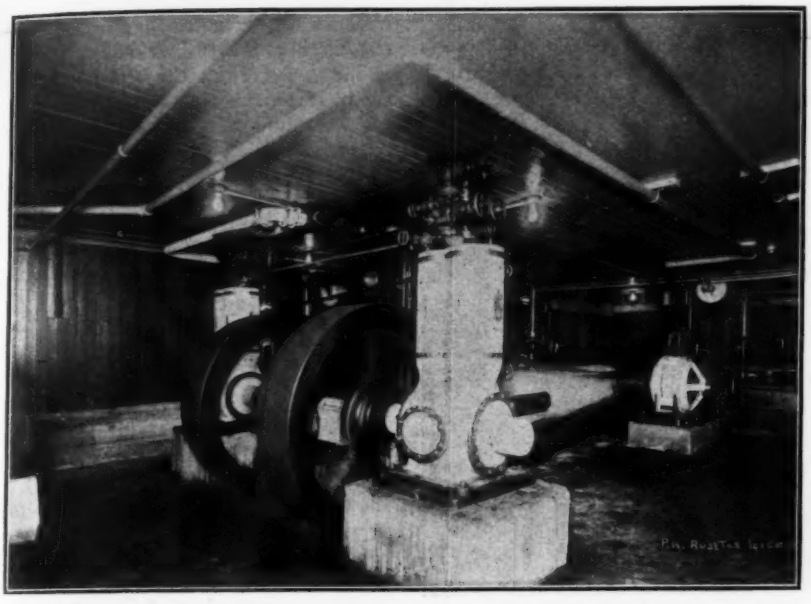


Brine-Jacketed Mixers, Motor-Driven.

Ice-making and refrigerating plants can be classified under two distinct headings: (1) Compression plants, in which the gas is drawn from the expansion side of the plant by the action of a compressor, then compressed to a liquefying pressure, and finally discharged into the condenser. (2) Absorption plants, in which the heat of the steam is used directly to expand the ammonia gas in the generator, producing in this way sufficient pressure to cause the gas to liquefy in the water-cooled condenser coils. Passing from these the ammonia liquor is then evaporated in the expansion coils, in contact with the brine or material to be chilled, taking up in the process heat which is delivered to the cooling water at the end of the cycle. The steam used to boil the ammonia gas can also be condensed and collected as distilled water.

With absorption plants for every three engine horsepower, one ton of ice can be made daily. If the engine horsepower is estimated and divided by three the number of tons of ice that can be made daily is found. In order to make use of the exhaust steam from engine it is necessary to have a good supply of cool water from a well or other source for condensing purposes and this water generally has to be pumped. Power must also be used for operating the ammonia pump, distilled-water pump and ice-tank agitators. The total amount of power for all auxiliaries ranges from one-half to three-fourths horsepower per ton of ice, depending upon the height the water has to be raised in the well.

In the compression system, which is much to be preferred, a motor-driven compressor is employed to produce the



Ammonia Compressor Driven by Motor in Plant of P. A. Rusetos Ice Cream Company, Chicago.

pressure at which the ammonia liquefies in the cooling coils. The remainder of the cycle is similar to the absorption process. With such a compressor motor load extremely favorable conditions for improving the central-station load-factor are established for the compressor runs long hours daily and can be slowed down or stopped during the time of the electric peak.

It is somewhat difficult to accurately estimate the kilowatt-hours required to produce a ton of ice. This figure will naturally vary in different plants, local conditions being largely responsible for the variations. Investigations which have been made, however, fix this figure at somewhere between 50 and 60 kilowatt-hours for plants working on the compression system.

The power required to drive an ice-making plant will vary from 2.8 to 3.0 horsepower per ton of ice in the larger plants, to four horsepower per ton of ice in the smaller plants.

The horsepower required to drive an ammonia compressor when the back pressure and condensing pressures are known can be determined by aid of the accompanying table:

	MEAN EFFECTIVE PRESSURE.					
Back	Condenser Pressure.					
Pressure.	150	160	170	180	190	200
5	51	52	54	56	58	60
10	56	58	60	62	64	66
15	62	64	66	68	70	72
20	65	67	69	72	74	76
25	67	69	72	76	78	80
30	68	71	74	78	80	83
40	69	73	76	80	82	86

It is necessary to multiply the area of the piston in inches by the mean effective pressure found in above table; then multiply by the speed of the piston in feet per minute and divide by 33,000. This gives the horsepower required.

To this result 20 per cent should be added to take care of friction losses in the machines.

For example, the horsepower required to drive an ammonia compressor having a double-acting compression cylinder 10 inches in diameter by 18 inches stroke, running at 80 revolutions per minute, with 20 pounds back pressure and 180 pounds condensing pressure would be as follows:

Area of cylinder 10-inch diameter= 78.54, therefore $78.54 \times 240 \times 72/33{,}000 = 41.15$ horsepower. Increasing this by 20 per cent gives 49.3 horsepower required to drive the compressor.

Ice Making.

There are two methods of making clear artificial ice:

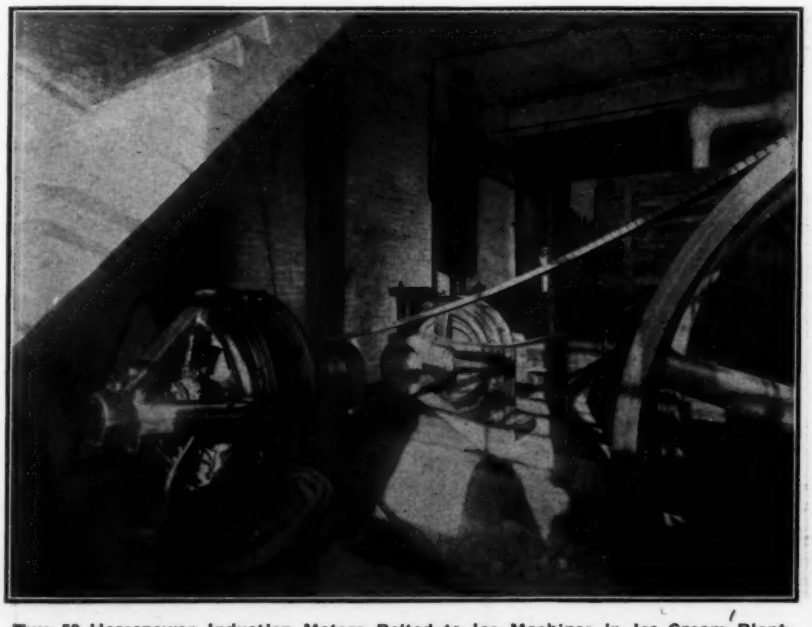
First. By agitating the water obtained from a drinking-water supply during the freezing process. This is known to the trade as "Raw-Water Ice."

Second. By condensing exhaust steam, and removing oil, gases, etc., from the distillate by means of oil separators, etc., and reboiling the distillate to remove the gases in solution, then freezing the distilled water, without any agitation. This is known as "Distilled-Water Ice."

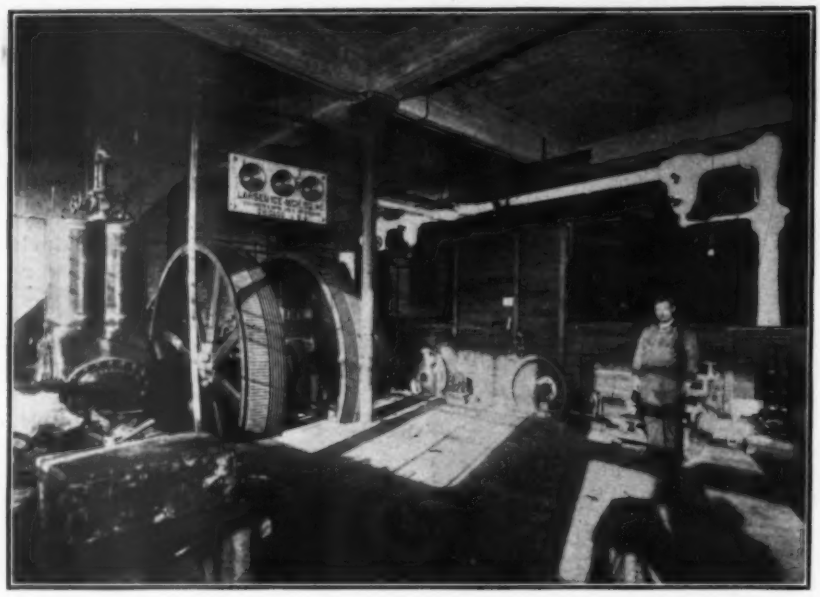
Whether a raw-water or a distilled-water system be installed depends upon the chemical constituents of the local water supply. There are certain grades of water which will never furnish a clear cake of ice unless chemically treated, while other waters are of such condition that chemical treatment will cost too much. In such a case, a distilling system is necessary to furnish a clear cake of ice.

A thorough chemical analysis and report by those versed in the mysteries of raw-water ice-making should be obtained before an ice or ice-cream manufacturer decides upon a raw-water system. If the water is found to be satisfactory, it can be frozen into ice that is commercially perfect from all standpoints.

Ice making by the raw-water process is coming into extensive use and has opened up a desirable field for the utilization of electrical energy. To the ice manufacturer this process appeals in a very strong manner, as it removes the necessity of locating plants in such locations that permit of ready and convenient supplies of coal. By using the raw-water process an ice plant may be



Two 50-Horsepower Induction Motors Belted to Ice Machines in Ice-Cream Plant.



Motor-Driven Compressor in Ice-Cream Plant Where Steam Engine was Previously Used

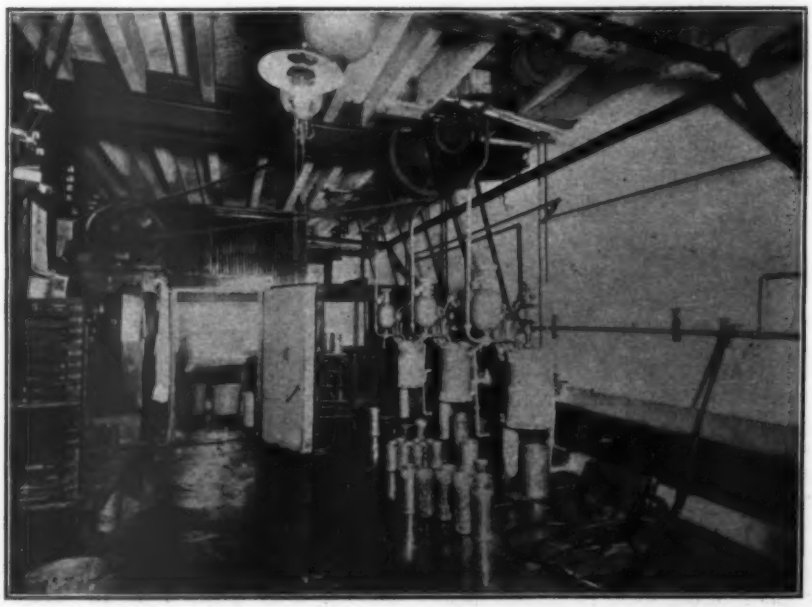
situated in thickly populated sections of a city, near or in the heart of the distribution district for the product, thus eliminating the necessity for a great amount of cartage.

The raw-water process requires no steam and hence no coal, for electric power may be used throughout. The process consists of forcing air into the center of the ice tanks during the freezing process. All impurities pass to the center of the tank and when the main portion of the ice is frozen, the impure water in the center of the cake is pumped out, the hole refilled and the process continued.

The plant of the Lincoln Ice Company, Chicago, is a typical raw-water plant, making 200 tons of ice per day. It has one story, the atmospheric condensers and cooling towers being located on the roof.

Power is obtained from the 4,400-volt 60-cycle line of the Commonwealth Edison Company and transformed to 220 volts by means of six single-phase transformers, two transformers being designed to operate in parallel across each of the three phases. These transformers are of the outdoor type and are installed on a pole structure reaching a few feet above the roof level, the poles being near enough to the building to permit of easy access to the transformers from the roof.

The ice-making capacity of any proposed plant should be sufficient to take care of the present maximum daily use and sales of ice in summer. Future growth of business can be taken care of by building an ice-storage house, storing up ice in the dull winter season and drawing from the store house in the busy summer season.



Motor Driving Group of Ice-Cream Freezers and Can Washers in Chicago Plant

As an indication of the desirability of installing a small ice-making plant and operating 24 hours daily, rather than installing a large capacity plant and operating 10 or 12 hours daily, it may be stated that to manufacture five tons of ice in 24 hours, would require a total consumption of 250 to 300 kilowatt-hours, depending upon the season of the year and temperature of water required to serve the ice-making machinery, or in other words 50 to 60 kilowatt-hours for every ton of ice made. The maximum demand for power at any one period would be about 18 kilowatts for a five-ton plant or about 3.5 kilowatts for every ton of ice made, if the ice plant is operated 24 hours daily. If it is desired to operate ice machinery only 12 hours daily, the maximum demand would be double the above, although the total consumption would be about the same.

A plant built to make a certain quantity of ice to operate 12 hours daily will cost considerable more than a plant built to make the same quantity of ice, but operating 24 hours daily.

Aside from refrigerating and ice-making machines no special problems are presented in the application of electric motors to the various machines employed. Ice-cream mixers, pumps, can washers, ice crushers, conveyors, etc., all operate at constant speed, and where alternating-current service is available are best driven by the induction motor with squirrel-cage windings.

A "Made in Little Rock" Display.

The commercial department of the Little Rock Railway & Electric Company arranged a "Made in Little Rock" display recently in which was featured a large variety of articles manufactured in Little Rock by the use of electric power. About 25 manufacturers took advantage of the opportunity and one of the exhibitors, a manufacturer of ice cream and dairy products, gave away butter-milk and ice cream for two days. The display itself was exceedingly interesting and created much comment which was the means of bringing a large number of people to the Electric Shop.

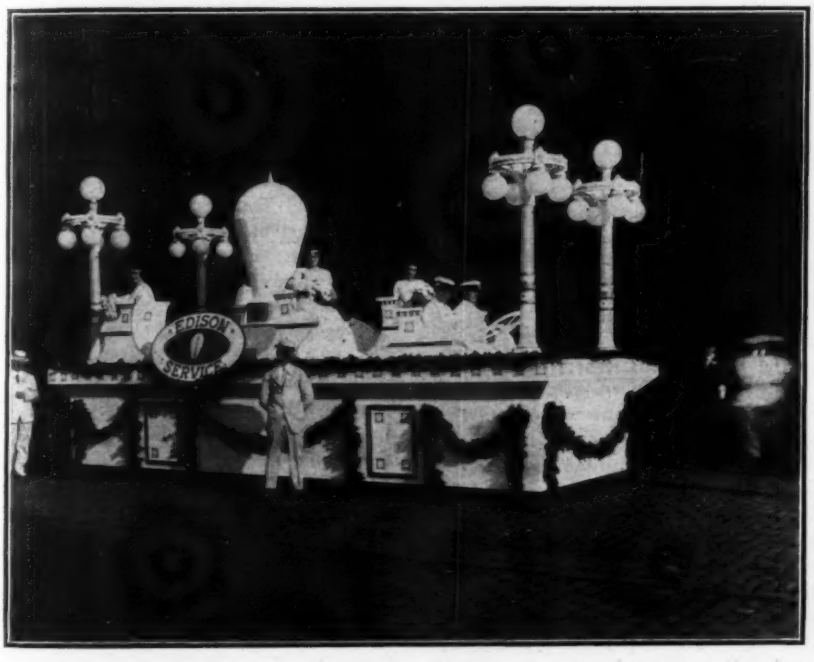
Twenty-four house-wiring contracts were secured during the month, the work being aided materially by the fact that the city gas was turned off for three weeks.

The Birmingham Railway, Light & Power Company, Birmingham, Ala., has recently closed a contract with the Hillman Hotel calling for an installation aggregating 160 kilowatts. The isolated plant will be abandoned.

Commercial Practice
Management, Rates, New Business

Central Station Participates in Parade.

The eleventh annual convention of the Associated Advertising Clubs of the World was held in Chicago, June 20 to 24 inclusive, 1915. This was one of the largest conventions of Ad Men ever held. Monday evening, June 21, the convention was opened by an elaborate night pageant participated in by advertisers in all lines of business whose products were visualized in floats, trademarks, uniformed horsemen, pretty girls, etc. The parade was one of the greatest night pageants that Chicago has ever seen, requiring about two hours to pass a given point.



Float of Commonwealth Edison Company in Recent Advertising Parade in Chicago.

Electricity played a prominent part in this pageant and a number of electrical firms were participants. In addition to being illuminated by means of storage batteries, these various floats were also lighted at given points by means of batteries of huge searchlights installed on the roofs of buildings along the line of march.

The Commonwealth Edison Company entered two floats, one of which is here shown. This float was mounted on an electric truck; the decorations were classic in design and the float carried a group of girls in classic costume. Four ornamental street posts, each containing five Mazda lamps, 60 watts each, occupied the corners of the float. Garlands of green foliage placed on the sides of the float were illuminated with strings of miniature Christmas tree lighting outfits. There was a huge lamp in the center and an oval trademark of "Edison Service" on either side of the float. White carnations were thrown among the spectators during the entire line of march by the girls on the float.

The Chicago Telephone Company displayed one illuminated float showing a huge model of the telephone directory and another illuminated telephone instrument on a truck loaded with "Hello" girls.

The Edison Lamp Works also had an illuminated float. The Thomas Cusack Company made a very elaborate display consisting of five electrically illuminated floats and illuminated banners. The American Express Company was represented by means of a beautifully illuminated float. The Lindstrom-Smith Company had an electrical float depicting the use of electric vibrators.

Starting at eight o'clock from Michigan Avenue at Twelfth Street the line of march was north to Randolph Street, west to State Street, south to Jackson Boulevard and west to Market Street.

Concord Advertises Advantages of House Wiring.

The Concord Electric Company, Concord, N. H., is offering the following suggestions with reference to the wiring of houses for electricity, in advertisements in the local newspapers:

"Consider the advantages of an electrically lighted home:

"1. It is lighted at less expense than it could be by candles or kerosene.

"2. It is most attractive.

"3. It is easiest to sell or to rent.

"The man who has his home wired has invested his money profitably. Isn't it about time your family enjoyed the advantages of an electrically lighted home?"

Lighting Installation to Aid Real-Estate Sales.

The first step electrically in the improvement of a 1,000-acre city addition—one of three or four of equal size in the country—is a contract just placed by the King Thompson Company, of Columbus, O., for 68 light standards. These are to be erected on the portion of its Upper Arlington suburb of Columbus, Ohio, that marks the beginning of its development. The standards are to be of marble dust and crushed granite, 11 feet high above the foundation. Current supplied by the Columbus Railway, Power and Light Company will be carried to the standards by an underground cable.

Flat Rate Abandoned by Municipal Plant.

The municipal plant of Brigham City, Utah, has recently passed a regulation requiring all customers to install meters. The municipal electric plant has been operating for several years on a flat-rate basis, but it was found that the plant's transmission and distribution lines were kept loaded by the extravagant and needless use of current by the patrons, which rendered it difficult if not impossible to give good service. The installation of meters is being done under the supervision of the city electrician, Julius Wright, and will require about two months, after which time all flat-rate service will be discontinued.

New Offices of Utah Power & Light Company.

The Utah Power & Light Company has consolidated all of the offices in its Salt Lake Division in its new office, which occupies the north half of the ground floor of the Kearns Building at 132 Main Street. Heretofore the commercial office and electric shop have been located at 154 Main Street, and the lines and service department, and other operation departments in the old office building at 133 South West Temple Street. The new arrangement will enable the company to render much more prompt and efficient service to its patrons. The new quarters occupy a floor space of 40 feet by 180 feet with balconies on the front and rear end of the room. The front part of the main floor is given over to an electric shop and display room, the principal feature of which is a complete line of electric ranges of the principal range manufacturers. The main office is reached through a commodious entrance on either side of which are capacious display windows. The rear portion of the main floor is given over to the commercial office and accounting department. It is separated from the electric shop by a mahogany screen with bronze trimmings, behind which are located the receiving tellers' cages, the information and application clerk, duplicate bill clerk, and other employees who have occasion to wait on the public.

A commodious room in the front basement has been fitted up as a demonstration room. An elevated platform in one corner equipped with a hood for carrying away the cooking fumes, sink, refrigerator, etc., supplies all the facilities of a modern kitchen. Special cooking demonstrations may be given there, or an interested prospect may be taken down there by the company's regular demonstrator, where the efficiency of electric ranges may be shown the prospect, or where she may prepare food on the range herself should she be interested in doing so.

The company's general offices are located on the fifth floor of the Kearns Building, and this recent move places all of the general and local offices in close contact.

Vacuum-Cleaner Campaign in St. Louis.

A vacuum-cleaner campaign being conducted by the Union Electric Light & Power Company, St. Louis, Mo., is resulting in numerous sales. The company is using considerable newspaper space, announcing that it will allow a 15 days' free trial and if purchased, the cleaner can be paid for in monthly installments. A special price is made during the campaign.

Street-Lighting System in Hartford.

The Board of Street Commissioners of Hartford, Conn., in its annual report, describes the contracts under which the Hartford Electric Light Company is providing for the lighting of the streets for a five-year term.

One contract is for ornamental lighting, which is by means of 300-candlepower nitrogen-filled units on single and double poles 15 feet high, furnished by the city. There are now 183 double and 80 single lights, the lamps being installed in acorn-shaped diffusing globes. Poles are 60 to 100 feet apart. The rate for the double lights is $80 a year, and for the single $55 a year, the lamps burning all night.

General lighting is covered by the second contract, which is for 700-candlepower nitrogen-filled lamps in Holophane refractors and plain glass globes, 23 feet above the street. Secondary lamps, of 125 candlepower, are installed on 15-foot posts. There are 576 of the 700-candlepower units and 1,705 of 125 candlepower. The city pays $55 and $60, respectively, for supplying the larger units for overhead and underground supply, and $17 and $22, respectively, for the smaller lights. The company provides and maintains all equipment except the standards.

During the coming year about 48 300-candlepower lights will be added to the system.

Electric Vehicle Parade at British Municipal Electricians Meeting.

For the parade of electrics on the Victoria Embankment on June 17 there were 17 vehicles entered, the demonstration being arranged by Mr. Ayton's committee. They included a 1,000-pound Walker covered delivery van (Edison battery); a 2,000-pound open-body wagon (Edison battery) by the West Ham corporation; a 1,000-pound Opel covered delivery van, by Marylebone council; a 900-pound covered delivery van by the General Vehicle Company, Limited; a 4,000-pound automatic tipping refuse van (Edison battery); a 2,000 or 4,000-pound Edison chassis; a 2,000-pound delivery van (Edison battery) by Pullors of Perth; a 2,000-pound Baker chassis with box van body (Ironclad-Exide battery) and a 4,000-pound Baker chassis, both by Wolseley Motors, Limited; a three-people passenger roadster by Croydon corporation; a 1,000-pound Opel covered delivery van (E. P. S. battery) by Poplar borough council; a four-people electric landaulette (lead-plate battery) by Hertford Street Motor Company; a 1,500-pound Opel light delivery van (Hart battery) by Heston and Isleworth council; a four-people electric landaulette by Krieger Electric Carriage Syndicate (Naylor lead battery); a four-people Milburn coupé (Philadelphia lead battery), by Heath's Garage; a four-people Lang coupé (Ironclad-Exide battery) by Heath's Garage; a 7,000-pound Baker electric lorry by Wolseley Motors, Limited.

Panel-Board Campaign Successful in Louisville.

The July bills of the Louisville Gas & Electric Company carry on their backs a drawing showing a typical use of the new electric panel board, installed for $2.99 cash by the company and co-operating contractor, and a statement as to the service. In the display room at the company's offices a similar idea has been worked out with an actual panel, a fan and pedestal and an ironing board, with a dummy, borrowed from a ready-to-wear store doing a good day's work with an electric iron. Both are attracting a good deal of attention.

Use of the bills of the company for advertising special points of service is proving exceedingly effective and results are being gained constantly.

Demonstrating on Dead Signs.

During the month of May the Colorado Springs Light, Heat and Power Company conceived the idea of utilizing several dead signs for the purpose of demonstrating the value of Mazda sign lamps, as a source of more effective illumination. Two of these signs have been dead for several years, but were revitalized by the installation of 10-watt Mazda lamps, and so good a showing was made that the owners gladly purchased lamps, signed up contracts and resumed the use of the signs. Three flat-rate signs were added to the circuits during the month with an estimated annual revenue amounting to $174.00.

Extension of White Way in Lowell.

Fifty new 6.6-ampere magnetite arc lamps, forming an extension of Lowell's White Way, described in the issue of June 12, have been provided as the result of activities of business men's organizations, on upper Merrimack and Middlesex Streets. The openings were celebrated by band concerts and red-fire displays. The Lowell Electric Light Corporation furnished the apparatus and energy.

Seasonable Advertising in Brockton.

The Edison Electric Illuminating Company of Brockton, Mass., taking advantage of the season's suggestions, is pointing out in its advertisements the suitability of electrical apparatus such as coffee percolators, toasters, water heaters, chafing dishes, etc., as gifts for brides. Such appliances, it says, are bound to be welcome in the new home.

Efficiency Meeting in Louisville.

At a recent meeting of the Employees Club of the Louisville Gas & Electric Company three of the department heads were on the program for reports of their trip to northern city plants, just completed, and during which they were shown the inner workings of the plants they visited. They went in search of ideas, and reported various kinks and efficient points they picked up. They stated also that they were able to return well pleased with the efficient organization of the Louisville company.

L. S. Streng, superintendent of the electric department; W. A. Cowherd, general storekeeper, and McKay Reed, manager of the work order and voucher department, were the three who made the trip, visiting St. Louis, Minneapolis, Chicago, Indianapolis and other cities, as well as the big plant at Keokuk, Iowa.

The Louisville company is using small blueprints for the announcements of these regular Employees Club meetings.

Domestic Science Lectures to Give Impetus to Electric Range Sales.

The Utah Power & Light Company has engaged the services of Miss Mary Gray Marston, an electric range expert of New York City who is giving a series of exhibitions throughout the various divisions and districts served by the company. Miss Marston's talks are purely educational in their nature, the company believing that if the housewives can be educated to appreciate the simplicity, quality and economy of electric cooking, that they will not be slow to take it up. The women, and many of their husbands, are evincing a keen interest in these exhibitions wherever they are given, and there is every indication that the development of the electric cooking field in the company's territory will be a rapid one.

Attractive Show Window Aids in Iron Sale.

The usual summer campaign for the sale of electric irons was begun July 1 by the Kansas City (Mo.) Electric Light Company. An incident of the advertising is the display in the company's show window on Grand Avenue, comprising a miniature ironing board on which one of the irons offered is seen ironing a piece of cloth, with no visible means of propulsion. An elaborate equipment was necessary to attain the effect. The heavy iron required a strong magnet, and special means of moving the magnet. The devices were made in the company's shops, parts of equipment from street cars being used.

SUCCESSFUL COMMERCIAL MANAGERS.

H. N. McConnell.

"I have been through the mill in the central-station selling game, as salesman and department manager in several cities; and of recent years, as general commercial manager of a holding company, have aided in the reorganization of other properties in cities widely different in size, location and character. I have found, almost without exception, that the selling end of the business is not only the most neglected, but the most profitable for the company to improve. I have found that the old cry of 'Our conditions are different,' is just the cry of inexperience from the man in the rut; for the model selling system that we have worked out as our standard has proved a correct fit under every condition where it has been installed; and that means some 20 cities, scattered through seven states, from Colorado to Connecticut and from Texas to the Lakes." These are the words of H. N. McConnell, commercial manager of the United Gas & Electric Engineering Corporation of New York, controlling utility properties in 21 cities of the country, and in a measure they indicate the reason for the almost unparalleled commercial growth of the companies under his management. Mr. McConnell believes in a definite selling system for central stations. He has made this his hobby and throughout the central-station industry is considered as an authority on commercial department organization. There is nothing radical in Mr. McConnell's code for new business operation. His ideas are based on sound business principles, but attention to details is the secret of his success. In his own words, "there are a dozen things, most of them mere details in the day's work, and yet details that make all the difference between a well-built, smooth-running machine and a bunch of overbusy parts."

H. N. McConnell, General Commercial Manager, United Gas & Electric Engineering Corporation.

Coming from the New York Edison Company in 1907 as power salesman, Mr. McConnell associated himself with the Elmira Water, Light & Railroad Company in the same capacity, later being made commercial manager of that company and from there transferred in 1909 to the same position with the Colorado Springs Light, Heat & Power Company.

His successful management of these local commercial departments led to his promotion in 1910 to the post of general commercial manager of all the properties, which he now holds. Mr. McConnell now supervises the commercial activities of 21 public utility companies in cities serving a total population of over two million.

Mr. McConnell has served on the Board of Directors of the National Commercial Gas Association, and is a member of the Executive Committee of the Commercial Section of the National Electric Light Association.

It is safe to say that much of the company's commercial growth may be directly attributed to his early adoption of modern practices and placing the commercial department of each company in a position which has enabled it to be of the utmost value to the company as well as to the public served.

Minneapolis Company Presents Fountain to Public.

When the Minneapolis General Electric Company constructed its new substation at Thirty-ninth Street an artesian well shaft was sunk inside the building. The water from this well became famous in the neighborhood and in order to accommodate the public the company erected a white-tile fountain outside the sub-station. On a plate appears the following inscription.

"Presented to the citizens of Minneapolis by the Minneapolis General Electric Company."

Brooklyn Company Discontinues Prepayment Meters.

The Edison Electric Illuminating Company of Brooklyn proposes to remove all prepayment meters which it has in service. This move has been opposed by consumers, one of whom has taken the matter before the Public Service Commission for decision. In this case the yearly revenue is about $10 per year. With the ordinary meter there is a minimum charge of $1.00 per month.

Electrical Construction

CONTRACTORS' OFFICE FORMS AND SYSTEMS.[1]

By M. J. Lavalle.

Recently I talked with a manager of one of the large wholesale concerns on office systems, and asked him how he succeeded in establishing an efficient system in his office. He quietly answered: "I haven't succeeded." No concern ever succeeds in establishing a perfect system in its establishment.

While we try and have at all times an efficient and as near perfect system as possible, there is always a larger goal ahead, making it necessary to alter our systems accordingly.

Efficiency, in my estimation, is the first step towards system in the offices throughout any organization. Look back ten years. Think what we had paid for experience. If we had known then what we know today how much time, health, money, faith and energy we could have saved. Efficiency offers the only short cut to success.

The American slogan is efficiency. We aim at world supremacy and the world master must be, first, a self-master. The difference between a hod carrier and the head of a large concern is that the hod carrier works his hod instead of his head. For the hod he has trained his muscle; to the hod he is bound. To get ahead one must have a head. How many of us work the hod instead of our head? I simply bring out one of the essential parts of any working force, co-operation and efficiency, to show that no matter how good or practical our forms and systems may be, we must have co-operation, efficiency and competent help to carry them out, and we ourselves must be efficient. What is efficiency? Efficiency is the power of doing one's most and best in the shortest time and easiest way to the satisfaction of all concerned. What is co-operation? Co-operation is a term in social economics, implying the association of any number of individuals or societies for mutual profits.

But I am getting away from the subject of job estimating and the value of comparing same with completed jobs.

A reference of some kind is necessary for estimators and electrical contractors, as well as for lawyers and doctors. It is impossible to remember everything. It is hard to keep many figures in the mind without an occasional reference to tabulated results gained from experience and comparison with completed jobs. If we keep a complete record of all actual cost of labor and material on finished jobs and compare same with estimates made on such work, it saves time and guess work, for what has once been done can be done again. It preserves the old and gathers the new.

There are many new things for each succeeding generation. It is better to keep a record than to lose the old that is useful or the new that is continually met with and welcomed.

Doctors and bricklayers are not the only ones that disagree. Some years ago, while the Leamington Hotel was being built in Minneapolis, after we had signed up the contract, a certain electrical contractor of another city said to me: "You got a good job. I had a cost of $18,000 on that job, and if I could have got my bid in in time would have received the contract." He was probably honest in his statement, but did not figure conditions as they actually were, but simply as it showed on paper. I would like to get acquainted with his system of figuring. Now, my cost on this job was $26,000. When the job was completed the cost ran up to $28,000. The specifications called for all conduits to run over the tile, and it also stated that the building ordinance should form part of the contract, and should be adhered to in every detail. Of course, I figured to run over the tile, but after the building was started we found that the amount of concrete on top of the tile was not sufficient, according to our building ordinance, to allow running our conduits as specified, but we had to run all conduits at right angles in concrete beams, thus increasing the quantities of conduits, wires and labor considerably on the entire installation on which we did not figure. Where would that $18,000 cost be, I should like to know? Some of the contractors here in this room probably remember the circumstance I refer to.

When a friend asked Dr. Johnson how he came to define "pastern" a wrong way, he bravely answered: "Sheer ignorance, sir." I am convinced that as many low bids arise from "sheer ignorance," as from any desire to prove in the face of common experience that two and two equal five.

The astounding developments in methods of electrical construction made necessary by the development in the general building lines and the changes in rules and ordinances in different localities have upset and turned all our figures upside down. It is time for us to recognize the necessity of checking our estimating with the completed jobs and regulate our units accordingly, thus making some kind of a standard to go by, and those who refer to these acquired standards, will not, of course, bring in bids varying over 2.5 to 5 per cent, but the present differences ought not to exist. They are sometimes large enough to make one wonder if all electrical contractors use the same addition and multiplication tables. Occasionally, however, there are factors that enter into a bid that make a larger difference than seems warranted by price of labor and material. There are often cases where "B" is sure that "C" the successful bidder is going to lose money, while "C" has special or favorable prices on material that keeps him safe; or, again, "C" may know a better way of doing the work.

There are many differences as to the proper percentage to add and how to do it, but the cost plus a fixed sum overhead (whatever that may be) and at least 10 per cent profit is a good system. And as a final word, on uniform bids, estimates, etc., I will say that it is well and often necessary to look at the dates when they were made. Prices advance or fall in a month or even less. An architect or contractor cannot control markets, monopolies or unions.

Perhaps I should say a few words as to how the estimating is done and trouable avoided. It might be as well to pass on without doing so, as experience is the best teacher, but something may be said. In the first place, there is no such thing as time in proportion to cost in estimating; $100 worth of one item may not take as long as the same amount of another item. Examine the plan carefully, before you promise your architect to take it back in a half hour.

1 Paper presented at meeting of Minnesota Electrical Contractors' Association.

In making an estimate I find it better and safer to keep each factor of a complete bid separate, to finish and double line it, and to make a summary of all the items at the end. By this method any error or change in plan (in fixtures suppose) can be added under its proper heading without affecting feeders or switchboard and panels; while if the total is carried from page to page it is impossible to change a figure wthout making a risky change necessary all the way through. This policy is almost necessary in making separations in case of change or alternate bids, and does not necessitate going all over your bid a second time. Get the exact cost and add whatever overhead and profit you think possible. You will not get anything extra in these later days. Some contractors add the profit on each item as they go along and can never tell exactly what they have apart from the cost. I do not think this a good practice.

"Order is heaven's first law." As far as possible make out an estimate in its natural order. Some specifications put the fixtures on before the wiring is in. Your service generally comes first, especially in larger installations. Have a definite system and follow it. We generally start with the feeders down to the distribution cabinets and risers for light, power, telephone, telegraph, and whatever other systems are specified. Then to the basement circuits, and outlets to first, second and whatever floors are specified. I think every estimator should first study his specifications and plan thoroughly and proceed as though he were actually doing the work, starting from the foundation up, taking in every detail, being sure to 'not miss one thing, from a service condulet to the installing of the lamp in the fixture.

Make out an estimate on a form so that it can be kept for record. If you land the job you want to check up, and if it is kept for five years you are sure to find use for it. Our estimates, plans and specifications are all kept intact for at least five years, and we always find them valuable. Keep a close record on time and material consumed on different jobs for future comparison. Why should the labor on one building cost more than on another under the same conditions?

It is, of course, a matter of choice, but I never like to hear a bid read out $5,000.21. I always think for mere good luck, the few cents ought to be given to the owner. Estimating is not an exact science like mathematics. I prefer to either add or deduct a few cents and make the bid even. It is easier to add, and in the end a fair average can be made.

In making an approximate bid to the owner or architect, be liberal. It is easier to deduct (or leave out) than to add. (Do not be afraid of an extra; it has its advantages.) Architects, as a rule, do not like extras, and the owner who orders them groans when the bill is presented. But why should they? The proper way to settle for an extra is before the tool is lifted, and the bill rendered at the end of each month. Short accounts make "long friends." Any architect that is worth house room will give a written order for an extra so that the contractor can go ahead. If he insists that it belongs to the original contract the time to settle it is while both parties have it fresh in their minds (the present).

I think it is but right that we should be paid for material delivered on the ground. Many states do this, and so does the United States. Finally, if you really put your foot into it, *"back out"* is rather an unpleasant thing to do, but it is sometimes better to sacrifice pride than dollars. The best of us will make mistakes, but do not get the "back-out" habit.

We all have heard tales of woe without number, too low prices, something forgotten, something left out, and so on to a dismal chapter. Add a fair percentage. It is unsafe to be without it. A percentage to our credit is a fine thing to have around a finished job. They all say so, but the trouble is that when one forgets it he generally gets the contract.

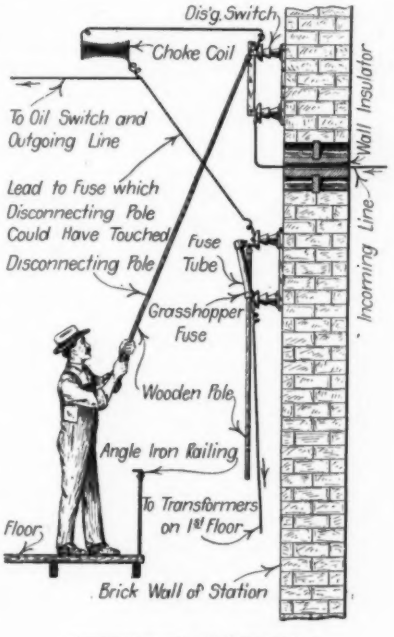
A contractor must have a fair acquaintance with every branch of his work. There seems to be enough in this field to engage the attention of one man. How much will it cost? is an important question that has to be decided before the final word is given to go ahead, and herein lies the responsibility of the estimator and contractor. He must do his work carefully enough to keep himself or firm out of the bankruptcy courts.

Unusual Accidents in Substation.

One of the most curious and unexplained accidents which has ever come to my notice occurred a little less than a year ago in the Hudson substation of the Bloomington & Normal Railway & Light Company, which operates a 33,000-volt transmission line of about 45 miles, supplying current to towns and villages in the west and north of McLean County, Ill.

This substation is a two-story structure, three 25-kilowatt, 33,000/2,300-volt transformers being located on the ground floor with the three-panel switchboard, and the lightning arresters, oil switch and choke coils on the top floor; the disconnecting switches and high-tension ("grasshopper") fuses for the primary circuit of the transformers being located on the wall and operated from the second floor.

During a thunder storm one afternoon, lightning came in on the 2,300-volt line and burned out one of the 2,300-volt circuit-breakers. The resulting short-circuit caused a rush of current which blew one of the grasshopper fuses in the primary, thus leaving only one phase in operation. In order to get the system in operation again, the substation attendant (who operates a telephone exchange in the front room of the station), called in a wireman who was doing some wiring in town. This wireman was better acquainted with the operation of the station than the attendant. He removed the fuse which was blown and renewed the fuse element, while the attendant and a man called from Bloomington transferred the secondary circuit to another switch. The



Arrangement of Apparatus.

wireman, having completed the repair on the fuse, proceeded to put it in circuit, this being accomplished by hooking it on the top terminal and letting it swing down in contact with the lower terminal of its own weight.

He had no sooner touched it to the top terminal, when current jumped down the wooden pole to his hands, knocking him at full length on the floor and setting fire to his shirt. The men below heard him cry, "Take it off! Take it off!" Rushing to his assistance they found him unconscious, and despite all efforts made to save him he died in a short time.

It now being about dark, the workers wanted to get things in operation as soon as possible, so the attendant thought by cutting off current at the disconnects, he could then insert the grasshopper fuse with safety. He

pulled off the two left-hand disconnects with the pole provided for that purpose, but the instant he touched the third and last one, current jumped down the pole to his hands, severely burning him and throwing him with considerable force on the concrete floor. Helpers were called in, who let him down, and after a short time he regained consciousness and was operating his telephone switchboard the next day. He had on common rubber boots at the time, but where he leaned against the iron railing a half-dozen holes were burned through his clothing, burning him considerably.

The attendant had repeatedly operated both fuses and disconnects and had never noticed any irregularity in their actions, but on this particular occasion things seemed to be beyond control, for current had to be shut off at the power house before anything could be accomplished.

Now, the question is, What caused the current to jump down the poles, which were both dry and perfectly clean, and had been used to handle full voltage many times before? It is possible that the disconnecting pole touched the conductor leading to the top terminal of the grasshopper fuse as the attendant reached for the disconnecting switch, as to operate the last one he would have to get rather close to it on account of it being close to the wall. However, the next day an electrician from the Bloomington & Normal Company tested the pole and found only slight leakage when a ground wire was wrapped around the pole only 18 inches from the upper end, when the end was brought in contact with a live wire; while the shortest distance over which current could have reached the operator, even by touching the lead to the fuse, would be at least five feet.

It could hardly be possible that there was a heavy charge of static on the line in the vicinity of the station, for by all laws of nature it should have passed off through the electrolytic lightning arresters provided for that purpose, which surely could have taken care of it so long as one of the disconnects was closed. Neither was there any lightning present at the time of the accident, as this was about three hours after the storm which burned out the 2,300-volt circuit breaker.

Paul M. Blough.

Among the Contractors.

The F. M. Grant Electric Company, Cleveland, O., has moved its office to 1518 Prospect Avenue. In addition to its improved construction and repairing facilities, the company announces it will carry a high grade of electrical merchandise, including Mazda lamps, fans, irons and heating devices.

HANDLING OUT-OF-TOWN WORK.[1]

By A. W. Lindgren.

Of course, the most important part of out-of-town work is to get the jobs first—but I will not disclose the secret of how to do this, as it is too valuable a secret to let go of. We will pass that part of it, and suppose that we have just received an $8,000 school job, about 100 miles from our place of business.

After having secured the job the first thing to do is to visit the job, familiarize oneself thoroughly with local conditions and ordinances, get acquainted with the architect, superintendent of schools, general contractor, members of the Board of Education, inspectors, and all of those people with whom one is liable to come in contact during the progress of the work. Right here is where the element of salesmanship enters in, and naturally the more agreeable one can make himself to the various people interested, the smoother the work will be carried on, and the better chance one has for securing extra work at satisfactory figures.

Our firm has never been so fortunate as to get a foreman for an out-of-town job who would pay his own board and room, so while you are on the job the thing to do is to secure for him a boarding place and a room, making the necessary arrangements for him. For helpers we generally pick up local men or send single men out of our own crew who are willing to pay for their own board and room, as this they would have to do in any event wherever they are. I might say right here, that quite frequently, we encounter competitors who apparently are able to secure foremen who are perfectly willing to pay their own expenses while out-of-town. In my estimation for a married man this is impossible.

Assuming that the job is about ready to start, the next thing we do is to thoroughly familiarize ourselves with details of plans and specifications, and then we go over these with the man selected as foreman for the job.

Before sending the man out, however, the necessary material which we have in stock is requisitioned and sent out, in order that it may be on the job when the man gets there, so that there will be no unnecessary loss of time. After this, at the proper time, the man is supplied with stationery, tools, expense money, etc., and sent out, after having received the proper instructions.

I might say here, in passing, that we aim never to substitute or deviate from plans or specifications without written consent of owner or architect.

1 Paper presented at meeting of Minnesota Electrical Contractors' Association.

On special items or supplies, where no specific make is called for, we, of course, do a little shopping around, after having secured the job, and if we have time, in order to see whether or not we can better the estimated price. However, one of the most important features in out-of-town work is to see that the men always have the necessary supplies and tools to work with, since if they are hampered by lack of these loss of time and money and unsatisfactory results in other ways are bound to occur.

During the progress of the work the foreman is required to send in time cards weekly for himself and men. He is also encouraged to write letters to the house regarding the progress of the work, extras which might come up, etc. He is also requested to anticipate his wants, so that he will not be held up for lack of material.

About once per month, or as often as necessity requires, the superintendent of construction visits the job—the better foreman you have the less times you need to visit the job.

Just before the end of each month we ask for an estimate on account from the architect basing our request on the amount of labor and material furnished to date. The usual terms of payment specified in the contract are, of course, 85 per cent of the value of labor and material gone in to date. If, however, you have a fairly lenient architect to deal with, it is quite possible to keep ahead of the game all the time; that is, to receive more money than the customary 85 per cent.

In completing a contract we try to finish the work just as quickly as possible, as it is generally here that a great deal of time is wasted. When the job is completed we try to have it accepted as quickly as possible, in order that we may get our money and make a quick get-away. After all, getting the money, is, of course, really the most important feature of all, since very often a contractor by not getting the money places himself in a position of being unable to even take any more contracts.

On time-and-material work we invariably try to have some one in authority approve the men's time before it comes to us, in this way eliminating chances for disputes.

In fact, as much as possible, we try to eliminate all causes for misunderstandings and disputes, as this is one of the disagreeable features of the contracting business.

New Mexico Coal Output.

The production of coal in New Mexico in 1914 was 3,877,689 short tons, valued at $6,230,871. This was the greatest coal output in the history of the state.

Public Service Commissions

Conducted by William J. Norton

ARIZONA.

The Pacific Gas and Electric Company has put in effect a combination rate for street lighting for blocks of 125 kilowatts or over, and for pumping to be supplied only from March to October, inclusive, in blocks of 75 kilowatts or over, at 2.5 cents per kilowatt-hour for such service in Phoenix. The company applied to the Commission for authority to put the rates in effect, but the Commission dismissed the application on the ground that their approval of the proposed rates was not necessary, as the laws of the state provide that all changes in rates, unless they are increases, may be placed in effect without the approval of the Commission.

NEW HAMPSHIRE.

Grafton County Electric Light and Power Company. In the decision of the Supreme Court of New Hampshire, which held, contrary to the finding of the Public Service Commission, that the consolidation to be brought about through purchase of the properties of the Mascoma Electric Light and Gas Company and the Lebanon Electric Light and Power Company by the Grafton County Electric Light and Power Company is for the public good (noted in ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, May 15, 1915, p. 906), the court says: "It is not for the public good that public utilities be unreasonably restrained of liberty of action, or unreasonably denied the rights as corporations which are given to corporations not engaged in the public service. The public utilities statute includes individuals as well as corporations in the category of those subject to supervision and regulation. Id. Section 1. This act is primarily one to regulate public utilities rather than corporations. The regulation of corporate activities is undertaken solely from a public service standpoint, and the powers conferred are to be administered accordingly. There is nothing in the statutes relating to public service corporations which in any way tends to contradict or limit this theory. Ample provision is made for supervision, to the end that unreasonable conduct may be restrained, but there is no suggestion that the affairs of public service corporations are to be treated on any but a sound business basis." (94 Atlantic 193.)

After considering the objections to the consolidation raised by the Commission, the court held that the transfer is lawful and reasonable, and, therefore, under the holding quoted above, for the public good. The case was remanded to the Commission with the instruction to proceed exactly as though the Commission had found that the transfer would be for the public good.

NEW YORK.

Supervision of Refunding Bonds. The New York Supreme Court, Appellate Division, First Department, issued an opinion in People ex rel. Dry Dock, East Broadway and Battery Railroad et al. vs. Public Service Commission for the First District, which holds that the Commission has supervision over the issue of refunding bonds, even though the original bonds to be refunded were issued prior to the enactment of the Public Service Commissions Law. The majority opinion of the Commission, prepared by Commissioner Maltbie, refused to approve the issue, for the reason that the company failed to furnish proof that the new or old debts represented property of equal value or cost, or that the obligations to be refunded were for capital purposes. The company contended in the proceedings before the Commission and before the court that where a public service corporation has valid outstanding obligations issued before the Public Service Commissions Laws took effect, it is entitled, as a matter of course, to obtain the consent of the Commission to issue new securities to refund them. This latter view of the case was also presented in a minority opinion written by Commissioner Williams.

The court discusses the Commissions Law relative to the issue of securities, and court cases bearing on the matter at issue, and upholds the majority opinion of the Commission. The opinion of the court, written by Judge J. Dowling, says that the settled policy of the state, as interpreted by the court (People ex rel. Binghamton Light, Heat & Power Company vs. Stevens, 203 N. Y. 7, 96, N. E. 114; People ex rel. Delaware & Hudson Company vs. Stevens et al., 197 N. Y. 1, 90 N. E. 60) requires that the commissioners, in their duty of protecting the public, determine, before they give their consent to the issue of refunding securities, that the purposes for which the original securities were to be issued were strictly capital purposes, and not expense or operating purposes.

"The fact that the effect of such a refusal to a refunding plan in a single case may be disastrous, as it is very apt to prove in the present one, is not the controlling consideration, but rather that, under the settled policy of the law as now determined by the Legislature, and interpreted by the courts, the approval of the Commission to the issue of new securities, whether it be for refunding or other purposes, is notice to the public that the securities so authorized by it represent at least investments made by the company for capital account and not disbursements for mere temporary purposes.

"While, therefore, the Commission was wrong in applying the test of the actual value of the company's property and its earning capacity as a criterion for its approval of the issue of these new securities, it was right in refusing to approve their issue until the relator had proven that the securities sought to be refunded represented actual investments for the company's capital account. . . . Nor does the fact that these obligations were incurred, in large part, before the Public Service Commission Law went into effect, determine the question, for the essential feature of the situation is the approval of the Public Service Commission now sought to be obtained for the refunding bonds, and the representation thereby made to the public as an accompaniment of such approval that they represent actual investments in the company's capital account.

"I, therefore, reach the conclusion that in a refunding case the inquiry of the Commission is properly directed to the following considerations, the evidence requisite to reach a determination whereupon should be furnished by the petitioner: (1) Whether the proposed issue is reasonably required for the refunding purpose. (2) Whether the expenditure to be refunded is a capital, as distinct from an operating or income charge. (3) If the expenditure to be refunded is an operating or

income charge, whether such refunding should nevertheless be permitted under the exception clause of the statute, which reads, 'Except as otherwise permitted in the order in the case of bonds.'" (153 N. Y. Supp. 344.)

WISCONSIN.

Madison Gas and Electric Company. The Commission has approved a contract whereby the Madison Gas and Electric Company will purchase energy from the Wisconsin River Power Company. The energy from the dam erected at Prairie du Sac will be brought 33 miles over transmission lines to the Madison distributing station. Under the contract the price for the power purchased is $7.50 per year per kilowatt of maximum demand up to, and inclusive of, a demand of 7,500 kilowatts, and an energy charge of $0.004 per kilowatt-hour. The contract covers a period of 25 years.

The Ettrick Telephone Company applied for authority to put in effect a rate to non-stockholders of $12 per year, alleging that its present rate of $8 per year is to stockholders who have invested $40 for a share of stock. The Commission states that in a previous decision the company was notified that a distinction in rates or charges between stockholders and non-stockholders was illegal; and that the application in this case is virtually an application for the Commission to authorize the company to charge an illegal rate. The application is dismissed, but if the company chooses to file with the Commission a rate of $12 per telephone per year, with a discount of $1.00 in cases where payment is made within the first quarter, applicable to stockholders and non-stockholders alike, such rate will be approved by the Commission.

In the opinion in this case, the Commission again calls attention to the proper and legal method of maintaining equality between stockholders and non-stockholders.

"In dismissing this application in the form in which it has been presented to the Commisson, we should perhaps draw attenton again to the proper method of handling such situations as this. The Public Utilities Law is very specific in its requirements that no discrimination can be made based either on the ownership of stock in the utility concerned or on the ownership of part of the equipment used to furnish the service. Where consumers furnish part of the equipment utilities are authorized to pay them a reasonable rental for such equipment as is furnished by consumers which is ordinarily furnished by the utility, or which the law contemplates should be furnished by the utility. The term 'reasonable rental' would seem to mean that the rental to be paid to consumers should not be more than a fair payment for the use of the consumer's equipment by the company. Where the company furnishes all equipment to both stockholders and non-stockholders or regardless of whether the company furnishes equipment in all cases or not, the law forbids a discrimination between stockholders and non-stockholders. If a stockholder has furnished part of the equipment and a non-stockholder has not furnished part of the equipment, the company can pay a reasonable rental to the stockholder for the use of equipment furnished by him, but this rental is paid because he furnishes the equipment, and not because he is a stockholder. In short, such a rental, if paid at all, must be paid alike to stockholders and non-stockholders if similar equipment is furnished by both.

"The fact that a stockholder has purchased a share of stock in the company, however, does not authorize the utility to supply him at a lower rate than non-stockholders are supplied. In purchasing a share of stock in the company the stockholder receives the right to share in the net earnings of that company if there are any. He does not, however, receive the right to receive service from that company at a less rate than service is furnished to parties who have not purchased stock. In other words, there must be no confusion between the relations which exist between the individual and the company because of the fact that the individual owns part of the company's stock and the relations which exist between them because the individual is a patron of the company. The same service is furnished by the company to the non-stockholder and to the stockholder. Their relations to the company as far as concerns the matter of service rendered and paid for should be identical. The non-stockholder, of course, bears no such relation to the company as the stockholder bears because of his ownership of stock, and consequently the non-stockholder is not entitled to share in the profits of the business.

"This, of course, raises the question of what method should be followed to secure equity in dealing with both stockholders and non-stockholders, in the matter of service. Many of the telephone companies in this state were originally organized primarily to furnish service to stockholders. With the development of the telephone business, however, the public nature of this business has become more fully recognized, and companies which originally were strictly mutual have found themselves under obligation to furnish service to the public without discrimination. As long as only stockholders were served it made little or no difference in the long run whether the definite annual rates were large enough to meet the expenses of the company and pay a fair return on the investment or not. As soon as the public nature of the business resulted in the furnishing of service to non-stockholders, however, the matter of annual rates became one of vital importance to those in whom the ownership of the company vested. If rates were less than the cost of conducting the business, including in this amount the cost of securing the use of the capital invested, the loss incurred in serving all patrons, including both stockholders and non-stockholders, must, of course, fall upon the stockholders who had invested their money in the business. The result has been a more or less natural conclusion on the part of the owners of these companies that non-stockholders should be charged more than stockholders are charged, and if the law permitted such a procedure it would not be impossible to fix the level of rates which the company ought to charge to all patrons in order to cover all expenses of the business and then provide a resonable reduction from this level for those who had their money invested in the business. This reasonable reduction, of course, would be equivalent to the fair return which stockholders ought to be entitled to earn upon the value of their holdings.

"The law, however, does not permit this course to be followed. All patrons must be charged the same rate, and the distribution of profits to stockholders must be determined by the condition of the utility resulting from its operations during the fiscal period under consideration. In the long run, it should make no difference to stockholders whether they pay in the first instance a somewhat lower rate than is paid by non-stockholders, or whether they pay the same rate and receive in the form of dividends a share in the profits of the business.

"In practical operation, of course, there will probably be a tendency in the case of a growing business to retain these profits in the business for the purpose of making extensions and improvements, so that there may not be an actual dividend payment in all instances. However, the retention of these profits in the business increases the value of stock holdings, and consequently results in the stockholders receiving a return on their capital in the form of increased worth of their investments instead of in the form of a cash distribution of profits. The fact that a company has not been on a dividend-paying basis means that some readjustment must be made if equitable relations as regards stockholders and non-

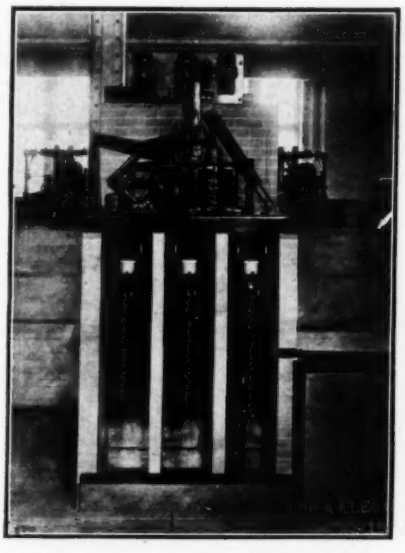
stockholders are to be established. It is unfair that non-stockholders should receive service without paying the full cost of that service under normal conditions.

To do this and comply with the law the company should establish a rate for all parties concerned sufficient to meet its full expenses, including a fair return upon the value of the property. With a rate fixed at this point there will be nothing to prevent the corporation from distributing in the form of dividends the amount available for return upon the investment, which is the greatest amount by which it would be reasonable to discriminate in favor of stockholders in the absence of a statutory provision forbidding such discrimination. If the company does not pay a dividend, but instead retains the money for improvement or extensions, it does so because it considers that a more satisfactory method of financing improvements and extensions than the borrowing of money to handle such extensions would be.

"Under the provisions of the Stock and Bond law of this state money may be borrowed to finance actual extensions chargeable to the capital account, or additional stock may be sold to secure the money for such purposes. There is, therefore, nothing in the law to prevent the stockholders of a telephone company from sharing in the profits of the business by receiving actual dividend payments, assuming, of course, that the rate to all parties has been fixed at what under normal conditions would be a reasonable point, that is, a point at which the rate will produce enough to cover operation expenses, expenses of current maintenance, expense of proper provisions for depreciation, and the expense of the use of capital which has come into the business and is represented in its property. If the company chooses to finance extensions and improvements by foregoing dividend payments, that is a matter for which no one but those who own the stock of the company can be held responsible. Consequently, if stockholders under normal conditions fail to receive in the form of dividends the full amount to which their ownership of stock might entitle them or an amount equal to the greatest discrimination which might reasonably be made in their favor, they have none but themselves to hold responsible. Of course, if conditions are such that the company is unable to earn a fair return on its property with rates at a reasonable point, stockholders cannot secure a full return upon their investment, but neither could they do so in the long run by any method of discrimination in rates between stockholders and non-stockholders. . . ."

New Combination Substation of the Philadelphia Electric Company.

Substation "E," recently put in operation by the Philadelphia Electric Company, is a concrete illustration of the spirit of co-operation now generally existing between the street railways and central stations. This building has the unique feature of housing two distinct substations, one a railway converter station, operated by the Philadelphia Rapid Transit Company and supplied from the Philadelphia Electric Company lines; the other an Edison substation, to handle the local power and light load. Located at Twentieth and Ludlow Streets, Philadelphia, it is close to an extensive residential section and in the center



Concrete Switch Compartment in Philadelphia Substation.

of a rapidly growing business section.

The building is of the most modern fireproof construction, embodying a steel skeleton with brick walls and concrete floors and roof. In the external architectural treatment the building conforms to the standard already adopted for the more recent substation buildings of the company. In the treatment of the interior an excellent effect has been secured by the use of white-enameled brick for wainscoting and panel, in a background of buff vitrified brick. A general interior view in shown in one of the accompanying illustrations which indicates clearly the interior construction, the trusses which support the concrete roof, the ventilating louvre, crane runway, and the line of supporting columns which marks the division between the railway and Edison substations. Ample light and ventilation are provided by the many wall openings and the louvre in the roof.

The Edison station is a combination alternating-current and direct-current substation, and the equipment comprises synchronous converter and static-transformer apparatus. The station delivers direct current at 110-220 volts to the Edison three-wire system, and alternating current at 2,400 volts to the two-phase 60-cycle distribution lines.

At the present time energy is received at 6,000 volts from a two-phase, 60-cycle transmission system. Ultimately this transmission system will be changed to 13,200 volts three phase, and an interesting feature of the high-voltage apparatus in the station is the fact that it is designed so that it may operate either system. Provision has been made for transformer equipment which will continue the supply of 6,000-volt two-phase energy to the Brush-arc motor-generator sets in the adjacent station "F" when the transmission system has been changed to 13,200 volts.

The electrical layout of the station provides for nine incoming feeders connected through circuit-breakers and selector switches to duplicate sets of unsectionalized high-tension alternating-current busbars, inclosed in concrete compartments. Circuits lead from these busbars to four booster converters, to the three-unit synchronous motor-generator set and to four step-down transformer banks. The converters and the motor generator supply duplicate sets of direct-current busbars, which may be tied together by bus-tie switches. The motor-generator can select either set of direct-current busbars; the converters cannot. The outgoing direct-current feeders are taken directly off the bus.

In the design of any power plant, the greatest efficiency can only be obtained when the physical arrangement of the apparatus is such that the energy enters at one end of the building, and passing directly through the various steps of transformation is delivered at the opposite end. This principle has been rigidly followed in the design of Station "E." Entering the basement through underground ducts, the incoming high-tension feeder is brought directly through the disconnecting switches and instrument transformers to the main oil switch.

The instrument for each incoming feeder consists of one ammeter connected permanently to a current transformer in the "A" phase wire, polyphase inverse-time-limit overload-relay equipment, and a pilot lamp connected to the voltage-transformer on the feeder. The pilot lamp is used to indicate that the feeder is alive. It is mounted on the switchboard in a specially designed hood with ground-glass face on which is painted the feeder designation.

On the same switchboard are mounted the necessary switches for operating the remote-controlled oil circuit-breakers. The control switches are of the twin-pull-button type, with the usual red and green indicating lamps to show whether the oil switch is closed or open. To actuate the control circuits, direct current is used at 125 volts, which is taken from two sets of three-wire control buses.

The main feeder oil switches are automatic circuit-breakers of 300 amperes, 15,000 volts capacity. The main oil switches are placed in separate concrete cells on the first floor of the station. Each of the three poles is entirely inclosed in a separate compartment with a removable asbestos-lumber door. A solenoid is used to actuate the operating mechanism of each switch.

After passing through the main oil switch the feeder returns to the basement and is connected by means of non-automatic selector oil switches to the bus-disconnecting switches on which the high-tension busbars are mounted. By means of similar selector switches each of the rotary converters may be connected through air-blast transformers to the busbars.

The energy flows from the 13,200-volt busbars to air-blast transformers and thence to the rotary converters. It is metered by the necessary number of alternating-current single-phase watt-hour meters connected on the high-tension side of the transformers, and by direct-current meters connected ahead of the direct-current busbars.

The present installation of conversion apparatus comprises two 1,500-kilowatt and one 1,000-kilowatt 60-cycle Westinghouse synchronous booster converters, one 500-kilowatt three-unit motor-generator set, two 4,000-kilowatt and two 6,000-kilowatt banks of air-blast transformers, making a total capacity of 24,500 kilowatts. In order to maintain a constant potential in the direct-current network, it is necessary to vary the voltage at the substation over a considerable range. Hence the rotary converters in this station are of the synchronous booster type, which allows a variation in voltage of about 30 per cent.

All of the converters now installed in this station are two-phase, 60-cycle machines. The 1,500-kilowatt units are operated as two-wire converters, whereas the 1,000-kilowatt unit is a three-wire machine, and with the 500-kilowatt motor-generator set takes care of the unbalanced load on the station. All three converters are arranged to start from the direct-current side, and apparatus is provided for synchronizing any machine with either set of high-tension busbars. The 1,000-kilowatt and one 1,500-kilowatt rotary converters are also furnished with equipment for starting from the alternating-current busbars.

The rotaries are protected on the direct-current side by means of solenoid-operated circuit-breakers of 10,000-ampere capacity which are mounted on the main floor by the side of the machine to which they are connected. The safety interlock on the direct-current starting switch, the use of which has been of value in connection with the speed-limit device on the converter, and the safety tap on the two-way field switch are interesting features of the installation.

In addition to the transformers stepping down the feeder voltage to the potential required by the converters, there are two banks of Westinghouse air-blast transformers for supplying the 2,400-volt alternating-current distribution lines. Each transformer bank comprises two 2,000-kilovolt-ampere and two 3,000-kilovolt-ampere single-phase air-blast transformers, which in the ultimate installation will be connected according to the Scott method of transformation, and will step down from the three-phase transmission voltage to the lower potential of two two-phase systems.

Special attention was paid, in the design of these transformers, to protection against short-circuits. The coils are strongly braced at the top and bottom by clamps, which hold the coils in place in case of short-circuit or sudden heavy load on the transformer. The coils are of pancake form and are wound with a single turn per layer. The complete coils are heavily taped and impregnated with a moisture-proof compound.

The ultimate capacity for which the station is designed is 6,000 kilowatts in direct-current, and 20,000 kilowatts in alternating-current apparatus.

Interior of Philadelphia Substation.

Increasing Use of Aluminum.

The quantity of aluminum consumed in the United States in 1914 was 79,129,000 pounds, against 72,379,000 pounds in 1913 and 65,607,000 pounds in 1912. The growth of the industry is shown by the fact that the production was 150 pounds in 1884, 550,000 pounds in 1894, and 8,600,000 pounds in 1904.

The value of the exports of aluminum and of manufactures of aluminum amounted to $1,546,510 in 1914, as compared with $966,094 in 1913.

Aluminum is the most abundant of metals and ranks third among the elements which compose the crust of the earth, being exceeded only by oxygen and silicon. It is never found native, or in elementary form, but occurs as an oxide, hydrous oxide, fluoride, phosphate, sulphate, silicate, or other compound. The only source of the metal so far commercially utilized is bauxite, an ore that contains 50 to 60 per cent of alumina (the common oxide), which corresponds to a metallic content of 26.5 to 31.8 per cent of aluminum.

The consumption of aluminum is constantly expanding, and aside from its use in the manufacture of cooking utensils, it is being employed in the construction of automobile castings and for wire for power-transmission lines.

The Board of Public Utilities Commissioners of the Philippine Islands has held that a telephone company may not cut out a subscriber's telephone to force the payment of a disputed bill. In a recent case the point was raised, and the board held that a disputed bill must be taken to court or otherwise settled without discontinuing the service.

American Institute of Electrical Engineers.

Annual Convention Held at Deer Park, Md., June 29 to July 2.

The thirty-second annual convention of the American Institute of Electrical Engineers was held at the Deer Park Hotel, Deer Park, Md., June 29 to July 2. The total registration was 204. The location of the hotel among the mountains was a delightful one, and the grounds afforded ample opportunity for outdoor games, had the weather permitted. Two rainy days, however, necessitated the abandonment of the tennis tournament, and lessened other outdoor activities. The golf match was completed nevertheless, E. W. Allen getting his name inscribed on the Mershon cup, while John R. Hewett carried off the cup for the runner up. The baseball game, played on Thursday afternoon, resulted in a victory for Captain Hall's team by a score of 13-11 in a five-inning game. Mr. Hall also carried off the prize for the longest tour by automobile, he and Mrs. Hall successfully negotiating the trip from Lynn, Mass. Prizes were also awarded in the contests for bowling, swimming, putting, cards, etc.

A feature of the convention was the attendance of Honorary Vice-President Harris J. Ryan as delegate of the San Francisco Section, an ovation being tendered him when he took a seat on the platform at the opening session.

The usual reception was held on Tuesday evening by President and Mrs. Lincoln, assisted by Honorary Secretary Ralph W. Pope, Past-President Dugald C. Jackson and other officers and ladies. This was followed by dancing.

A meeting of the Board of Directors was held during the convention, at which final action was taken in paying off the debt of over $50,000 which the Institute contracted in connection with the acquisition of the Engineering Societies Building. A report of the Standards Committee was adopted, making some changes in the present Standardization Rules.

The first session was called to order at 10:15 a. m. on Tuesday by President Paul M. Lincoln, who proceeded to deliver his presidential address. This was devoted to a consideration of the means of production and application of power, and a comparison of the progress made since 1898, when President Kennelly considered the subject, with the progress before that time.

A high efficiency of conversion between mechanical and electrical energy has been attained, efficiencies running above 97 per cent in some instances, and averaging probably 90 per cent. The conversion is somewhat more efficient in general from the mechanical to the electrical form, on account of the use of larger units and loading more nearly to capacity. With a margin of only 10 per cent, there is not much opportunity for improvement in this regard.

Prime movers have undergone great changes, and hydraulic motors now attain efficiencies close to 90 per cent. The thermodynamic engine has shown a remarkable development. Reciprocating engines have been largely displaced by turbines, the best of the latter attaining an efficiency of 75 per cent of that of a heat engine utilizing the Rankine cycle, which represents the best attainable. The average efficiency of turbines is not nearly so high, however. Since central stations use larger units and are more fully loaded, their better efficiency must cause them to prevail over isolated plants. The practical limitations to the best range in steam turbines can be met by increasing superheat or pressure; the latter seems more promising. The limit to size lies not in materials or design, but in possibility of application. The cost per watt of capacity has steadily gone down, reaching a value as low as 0.5 cent. Of the necessary costs involved in manufacture, that for labor is likely to increase, and that for materials is not likely to permit of much reduction. The limitation of heating sets the limit to the capacity of electrical machinery, and if insulating materials which will stand a higher operating temperature can be used, the cost per unit of capacity may be reduced. We cannot expect any radical change in power cost so long as the sources are water falls or coal. A more direct utilization of the sun's heat may eventually bring some improvement.

There may be a revolution, however, in the application of electric power, the importance of which is indicated by the wealth of material appearing in the *Proceedings* on this subject. There has been a vast improvement in lighting efficiency. Transmission lines have now been built up to a length of 245 miles and up to 150,000 volts. The use of direct current for transmitting energy brings some simplifications, but these are overbalanced by complications in generation and utilization. Testing voltages are now available over 1,000,000 volts.

While the developments in progress are not nearly so rapid as formerly, there is a consequent greater stability in the industry.

The first paper to be presented was one by J. B. Whitehead, entitled "The Electric Strength of Air."

Electric Strength of Air.

Some of the simpler fundamental experiments on the electrical conductivity of the air are described. The theory of ionization in gases is outlined in non-technical language. Townsend's proof that the law of corona-forming intensity $E = 32 + 13.4/\sqrt{d}$ is in accord with the theory of ionization by collision, is explained.

This paper was discussed by P. H. Thomas, F. W. Peek, Jr., E. E. F. Creighton, Harris J. Ryan, and L. W. Chubb. Mr. Peek explained the considerations, such as the requirement of a definite space in which to accumulate energy, and a time element, which led him to choose the form of equation finally adopted for the law of corona. He stated that coronas lasting only 0.5 microsecond were visible, and that discharges between needle points with alternating current sometimes seem continuous when they really consist of separate discharges from the terminal which is positive, extending only part way across the gap. As much as 10 kilowatts has been rectified by utilizing this property.

Professor Creighton spoke of the importance of the subject in lightning-arrester work, where the occurrence of a discharge depends upon an electron getting between the points.

Professor Ryan said that the theory of ionization should not be considered a failure because it does not explain much beyond the corona—it is still an infant theory. He referred to the importance of the time element, stating that only one-third as much voltage at 90,000 cycles is needed as at 60 cycles to discharge over a gap of 15 inches between a point and a plate. This is apparently because at the higher frequency ionization persists from one cycle to the next. The heating of the air at high frequencies at voltages too small to produce corona is not appreciable. Tests made in connection with this subject should include a variety of conditions, such as impulses, direct voltages, different frequencies of alternating voltage, etc.

In closing the discussion, Professor Whitehead said that the normal ionization of the air varied through a range of about one to four. Collisions are not the only source of ionization, which is produced by ultra-violet light, radioactive emanations from the earth, etc. In gaps shorter than the mean free path of a molecule, air appears to have a much larger disruptive strength.

A paper by John F. H. Douglas, entitled "The Reluctance of Some Irregular Magnetic Felds," was then presented in abstract by P. H. Thomas.

Reluctance of Magnetic Fields.

The historical development of the idea of magnetic reluctance is sketched, and the mathematical and experimental methods of determining it are first discussed. The magnetic field of an electric generator is next analyzed and made to depend approximately upon the reluctance of two-dimensional magnetic fields. The reluctance of these various magnetic fields is determined by experiments on the electrical conductivity of sheets of high-resistance metal cut in suitable forms, and by mathematical computation. These results are put into charts and formulas convenient for the use of those interested in electrical design. The results of the tests are proved to be more accurate than most of those already published. In particular, present leakage-flux calculations are most in error. There are two appendices giving some mathematical details, for reference purposes.

This paper was discussed by C. R. Underhill, J. B. Whitehead, Comfort A. Adams, F. W. Peek, Jr., J. D. Ball, L. W. Chubb and F. W. Carter. Mr. Peek pointed out the application of the method to dielectrics. Mr. Ball stated that magnetic measurements can be made more accurately than formerly, and the variation in material has been reduced to one-fourth what it was a short time ago. Accurate design of magnetic circuits is consequently more important. Mr. Chubb said that only a start had been made in solving magnetic problems on account of the complications arising from saturation, pulsation of flux, etc. He considered the pantagraph method of plotting flux more satisfactory than computation, and it could be applied in three dimensions rather than two. Water made a good conducting medium.

Frederick Bedell then presented a paper on "Irregular Wave Forms" consisting of three parts: "Form-Factor and Its Significance" prepared with the assistance of R. Bown and H. A. Pidgeon; "Distortion-Factors" prepared with the assistance of R. Bown and C. L. Swisher; "An Analytical and Graphical Solution for Non-Sinusoidal Alternating Currents," by F. M. Mizushi.

Form-Factor.

Form-factor is significant in the study of transformer losses; as is well known, hysteresis loss is small when the form-factor is large and *vice versa*. Every wave shape has a definite value of form-factor; but the converse is not true, for a particular value of form-factor does not indicate a particular wave shape. Form-factor, therefore, has no general significance as an indicator of wave distortion. A general expression for form-factor is derived in terms of the relative amplitudes and phase positions of harmonic components; curves are drawn showing the variation of form-factor with the amplitude and phase of the third harmonic.

Distortion-Factors.

A discussion of the significance and usefulness of deviation, peak-factor, harmonic-factor and curve-factor, is followed by a similar discussion of the differential distortion-factor, δ (which is the distortion-factor of the Standardization Rules), and a corresponding integral distortion-factor, σ, defined in this paper. Each factor has its own significance as a numerical measure of the departure of an irregular wave from a pure sine wave and hence has a special usefulness for special purposes, as well as a general usefulness as an indicator of wave distortion. A possible factor combining δ and σ is suggested. The variation of different factors with the phase, amplitude and frequency of harmonics is given. All the factors vary with the amplitudes of the harmonics; some factors are independent of their phase positions, while other factors are independent of their frequencies. Each factor has, therefore, its own characteristics. The importance of δ and σ and their combination is enhanced by the possibility of their use in alternating-current theory and calculation.

Non-Sinusoidal Alternating Currents.

The solution which is usual in case of sinusoidal currents for series circuits containing R, L and C may be modified by the introduction of current distortion-factors δ' and σ' so as to hold for non-sinusoidal currents. The usual solution for parallel circuits may likewise be modified by similar voltage distortion-factors, δ and σ. The general analytical solution for series and parallel circuits is followed by a corresponding graphical solution and a discussion of special cases. Not only are the effects of L and of C changed in value by distortion, but these effects are changed relatively in phase and are no longer in exact phase opposition as in case of sinusoidal currents and voltages. The mathematical transformations on which the solutions are based are given in an appendix.

The discussion of this paper, which was concluded at the session on Wednesday morning, opened with the reading of a telegram from the California Committee on Inductive Interference.

This pointed out that the work of the committee was necessitated by the occurrence of irregular wave-forms upon power lines, since the inductive interference was due to harmonics, mainly of the frequencies in the neighborhood of 800 cycles, to which receiving instruments are most sensitive. For that reason it is important to secure rotating machinery with a sine wave of the fundamental frequency. The Railroad Commission of California adopted a rule specifying that the wave forms used by the power companies should not deviate from a sine wave more than allowed by the Standardization Rules of the Institute. The rule adopted by the Institute covering this subject is therefore of great importance in this connection. The present rule is a poor one, especially as it does not penalize the higher harmonics sufficiently. The present papers show the limitations of the various criteria for departure from a sine wave. The most suitable, from the standpoint of inductive interference, is the differential distortion-factor. Tests made by the American Telephone and Telegraph Company show that the decrease in intelligibility is proportional to the strength of the harmonic, and proportional to the frequency up to a certain point. It then increases more nearly in proportion to the square of the frequency. A maximum is reached, however, at about 800 cycles, and the effect then decreases up to 1,500 cycles. Noise is usually due to a complex current of several frequencies. The effects of these several components are now being investigated. It is not considered necessary to investigate the effect of phase, on account of the work of Lloyd and Agnew. The requirements of a definition and measurement of departure from sine wave were then considered, and the various factors of the paper discussed from this standpoint. The differential distortion-factor most nearly fulfills these requirements, but certain harmonics should be weighted even more heavily. This might be accomplished by using a second derivative, although this would have no advantage over empirical weighting. The Standardization Rules do not now specify the condition of the machine as to load when the wave is determined. It is usually taken at no load, whereas the wave at full load is the important thing. It is very important to reduce wave distortion in power lines and approximate more closely to a sine wave.

L. W. Chubb considered the case of waves so much distorted that subsidiary hysteresis loops would be produced when used for magnetization. In these cases the form-factor cannot be used in the ordinary way for determining iron losses. The presence of harmonics of an even order makes it impossible to consider a single half wave. He pointed out errors in the work of the author due to not performing an integration from the zero point of the wave.

H. S. Osborne discussed interference in telephone circuits and exhibited curves giving the effect of different frequencies upon a telephone receiver and in causing interference. The interference co-efficient is a maximum at 1,600 cycles, where it has a value 80,000 times as great as at 60 cycles. Noise usually arises from those frequencies which are due to the presence of teeth and slots in the generators. It is sometimes caused by the high-frequency ripples from a direct-current machine.

Chester L. Dawes said that the capacity of a cable accentuates the distortion of the generator wave. He exhibited lantern slides illustrating this point. In cable testing, the peak-factor and measurement of peak voltage are important, and this is measured by a modification of the oscillograph to give an indicating instrument. He re-

ferred to a machine designed by Professor Adams to give a sine wave.

C. A. Adams discussed some of the features entering into the problem of securing a machine which would give a sine wave. He also presented a written discussion by W. V. Lyon, in which it was pointed out that the inconstancy of capacity, inductance, resistance and leakage complicate the problem and make Mr. Mizushi's solution inapplicable.

E. E. F. Creighton said that the use of an armature with a smooth core was the only way to get rid of harmonics. If there are teeth, there are some values of capacity and inductance which will bring out the harmonics.

W. J. Foster said that great improvements had been made in generators in the last five years with respect to wave shape. Generators of large size have larger air gaps, which tends to minimize the harmonics. A suitable standard is needed to test the wave. He considered the present deviation test the best which had been proposed and suggested that it be limited to three per cent on no load, five per cent at full load and unity power-factor, and seven per cent at full load and low power-factor. The sine-wave machines that have been mentioned have a low armature reaction, and are hence hardly commercial machines. In the latter a high armature reaction is required. This gives greater immunity from such troubles as short-circuiting. High armature reaction means large distortion. In large machines it will be hard to meet the requirements of the telephone company.

J. B. Whitehead also discussed this paper, and Professor Bedell then closed the discussion.

Tuesday Afternoon Session.

The session on Tuesday afternoon opened with a symposium on "Foundations for Transmission Line Towers and Tower Erection." This subject was discussed in papers by J. A. Walls, J. B. Leeper, W. E. Mitchell, P. M. Downing and F. C. Connery. Mr. Leeper presented his own paper and the others were abstracted by P. H. Thomas.

Foundations for Transmission Line Towers and Tower Erection.

BY J. A. WALLS.

Concrete tower foundations of mushroom type, requiring no forms or back filling, as used in recent Baltimore-Holtwood transmission line, are found to be cheaper and stronger than steel tripod foundations previously used in a similar line alongside. It was found that mushroom-type concrete foundations could be built with a smaller construction force and at lower cost and more rapidly, than certain types of concrete foundations requiring forms and back filling. The procedure of digging holes and concreting of mushroom-type foundations is described. Method of erecting transmission towers by the use of a shear leg is described in some detail.

BY J. B. LEEPER.

As tower anchors have been somewhat overlooked, causing in some instances much loss, these notes are written to call attention to the importance of properly designing them so that the maximum strength of tower may be obtained with the most economical outlay. The notes show: (1) a method of figuring the loads to be resisted by the anchors; (2) the importance of resisting the horizontal as well as the vertical loads; (3) the effect of the shape of the anchor on strength of tower; (4) various types commonly used; (5) the economy of the use of an all-steel anchor.

BY W. E. MITCHELL.

The development of the type of all-steel tower footing used by the Alabama Power Company for its 110,000-volt double-circuit steel-tower transmission lines is outlined, with a summary of the conditions influencing the designs finally arrived at.

BY P. M. DOWNING.

The author briefly emphasizes the fact that the weakest link of any transmission system is the line, and that this part of the plant has never been given the consideration it deserves. Towers are strongly advocated for important trunk lines, and certain conditions to be met in the design of same are given. The use of concrete footings is recommended in preference to those of metal set directly in the ground.

BY F. C. CONNERY.

There is a broad field open for designing and construction engineers in the design and construction of transmission towers and foundations. The purpose of the paper is to present a brief explanation of the types of towers, tower foundations, etc., along with a few details of field practice used in connection with the construction of two lines of towers carrying six 190,000-circular-mil, seven-strand copper conductors between Niagara Falls and Toronto. The question of dispensing with massive concrete foundations for towers is dealt with, and a number of alternatives are presented for consideration.

The discussion was opened by the presentation of written comment by R. S. McClelland. This was accompanied by charts giving a summary of tests.

A paper by A. Bang, entitled "Four Years' Operating Experience on a High-Tension Transmission Line," which was presented at a meeting of the Baltimore Section on February 26, was also included in the discussion. This paper gave a record of the operating events on the line of the Pennsylvania Water and Power Company between Holtwood and Baltimore. It includes observations on lightning flash-overs, deterioration of insulators, sleet on cables, and the means adopted to prevent disturbances to operation from these causes.

A. S. McAllister told of experience by a Japanese company which found insulators to deteriorate as rapidly in storage as in use. The deterioration was overcome by putting a thin layer of cement between the sections of the insulator.

E. E. F. Creighton complimented Mr. Bang's paper and said that a great deal of experience showed the deterioration to be mainly mechanical, such as different expansions of iron and porcelain.

E. A. Lof referred to a Swedish line of 70,000 volts now being constructed on which six graded insulators were used; with six equal insulators the voltage steps would be 11, 11, 13, 15, 20 and 30 per cent. With the thickness varied, the distribution of voltage is 15, 15, 16, 15, 17 and 20 per cent. This company also found the deterioration in storage as great as in use. This was considered to be due to the cement and the newer units have an air space left at the top of both inner and outer layer of cement, and a layer of graphite is placed on the porcelain next to the cement for electrical reasons.

Professor Creighton said that an insulator had been made without using cement. This type is more expensive, but may solve the problem.

H. V. Bozell suggested constructing a tower of hollow concrete poles.

L. C. Nicholson told of the results of using a megger to measure the insulation resistance on a line containing 40,000 insulators which had been in use for twelve months. Over two per cent of these showed zero resistance. This was mostly due to cracks in the porcelain at the base of the cap, presumably due to the pressure of the cap on the porcelain.

Mr. Leeper disagreed with Mr. Downing on one point; he said it was entirely possible to accurately compute the stresses produced by any assumed load.

The remainder of the session was devoted to a topical discussion on "Fields of Motor Application," which was introduced by David B. Rushmore. Mr. Rushmore presented an outline classifying the various industries and the points of interest in industrial operations. He gave statistics taken from the Census Bureau's report on manufactures in the United States. These showed the magnitude of each industry and the rate of increase. The items involved in the total cost of a finished product were tabulated.

The discussion was participated in by William M. Hoen, who considered motor drive in the oil flotation process for ore separation; H. D. James, who considered elevators; E. A. Lof, who considered the rubber industry; H. F. Boe, who discussed the applications of fractional-horsepower motors; William C. Yates, who discussed applications to printing presses; Thomas E. Simpers, who discussed applications to brick manufacturing. Other written discussions were contributed by C. A. Kelsey, on sugar mills; W. L. Merrill, on cement works; H. W. Rogers, on dredging; C. C. Batchelder, on pulp and paper mills. A printed paper by H. E.

Stafford on "Electricity in Grain Elevators," was also presented.

The general discussion was participated in by L. L. Tatum, J. C. Lincoln, J. H. Davis and M. G. Lloyd. Mr. Tatum said that it was not sufficient to determine the proper motor for any application, but that the installation should be followed through to see that it was done properly. Mr. Lincoln described a printing installation in Cleveland where the speed of the press was indicated on the meters in the office. Mr. Davis discussed the use of the vacuum system in grain elevators. This has great advantages over the old methods, but was not considered in Mr. Stafford's paper. Dr. Lloyd pointed out that two of the main items of manufacturing expense, the rent of land and interest on the investment in manufacturing equipment, were not included in the list of costs.

At the session on Wednesday morning, following the conclusion of the discussion of Professor Bedell's papers, two papers which had been requested by the Standards Committee to assist in the problems of nomenclature were presented, after some introductory remarks by C. A. Adams. The first paper was by Val A. Fynn, entitled "Classification of Alternating-Current Motors." The second was by Frederick Creedy, entitled "The Classification of Electromagnetic Machinery." In the author's absence the latter paper was abstracted by C. A. Adams. The two papers were discussed together.

Classification of Alternating-Current Motors.

This paper points out that in order to arrive at a rational classification of alternating-current motors it is necessary to base all suggestions on one and the same theory. The author thinks that the component-field theory is best suited to this purpose, and urges that it be always so applied as to bring out the very great similarity between the alternating and the well understood direct-current machines. Descriptive names are suggested for 44 alternating-current motors, including the principal forms of single-phase, polyphase, commutator and commutatorless machines now known. These names are such as to positively identify each of these machines. The rules followed in preparing the diagrams illustrating the various forms of motors and in selecting the proposed names, are given. In order to enable the reader to quickly judge of the aptness of these names, the theory of each of the motors dealt with is briefly outlined. It is thought that the information given will make it easy to correctly represent, describe and classify any motor which may have been omitted. It is further pointed out that the term "repulsion," as applied to motors, has never been defined, that no practical motors operate on what has been known as the repulsion principle ever since 1820, and that there is no justification whatsoever for the use of this term in connection with alternating-current motors. Such an indefinite term leads merely to endless confusion and should be abandoned. If it is not abandoned, it should be given a rational and definite meaning.

The Classification of Electromagnetic Machinery.

The author proposes to classify all dynamo-electric machinery according to five sets of characteristics, as follows: (1) Type of field, as constant-intensity, variable-intensity, multiple-polarity and homopolar. (2) Method of disposal of secondary power, which may be zero wattless, utilized in separate apparatus or transformed and returned to the line. (3) Use of commutators, which may be on either the primary or the secondary, or may be absent. (4) Method of magnetization, namely, high-frequency magnetization as the ordinary induction motor and low-frequency magnetization as in synchronous and compensated motors. (5) Method of connection. Many types may be connected either in series or shunt. A tabulation of these characteristics is given, by reference to which any dynamo-electric machine can be classified.

These papers were discussed by A. S. McAllister, H. M. Hobart, C. R. Underhill, C. A. Adams and Val A. Fynn.

Street Lighting.

The session on Wednesday evening was a joint meeting with the Illuminating Engineering Society. It was called to order by President Lincoln, who first introduced President-elect J. J. Carty. Mr. Carty responded by calling attention to the work accomplished by the Institute during the present year, which included paying off the Institute's debt for the Engineering Societies Building. He promised to continue the work for the welfare of the engineer.

Harris J. Ryan, honorary vice-president, was then introduced. He referred to the isolation of the Pacific Coast, and how it had been relieved by the opening of the Panama Canal and the transcontinental telephone line.

Farley Osgood then presented to Mr. Lincoln the past-president's badge with a suitable speech, to which Mr. Lincoln responded.

A. S. McAllister, president of the Illuminating Engineering Society, was then called to occupy the chair while Preston S. Millar presented a paper entitled "The Effective Illumination of Streets." This was accompanied with lantern slides and with demonstrations, utilizing an elaborate model set up in the room.

This paper mentions the dependence of effectiveness in street lighting upon municipal appropriations and efficient lamps, but discusses more particularly those aspects of effectiveness which are dependent upon skillful utilization of the light to produce the most effective illumination. There are included a classification of streets, a statement of the objects of street lighting (discernment of large objects in the street and on the sidewalks; discernment of surface irregularities in the street and on the sidewalks; good general appearance of the lighted street) and the elements of vision under street-lighting conditions. The paper emphasizes three considerations which are sometimes neglected in street-lighting discussions; namely, the silhouette effect, specular reflection from street pavements, and glare. The effect of glare in street illumination is dependent primarily upon (1) the extremes of contrast within view; that is, contrast in brightness between the light source and the illuminated surfaces; (2) the visual angles separating the glaring source from the observed surfaces; (3) the portion of the field of view which is illuminated. Glare militates against good street illumination in decreasing ability to see and in rendering unpleasant the appearance of the installation and the street. The remainder of the paper is given over to a presentation of the variables upon which the effectiveness of street-illumination depends, and the influence which each feature of the installation exercises through these several variables. These variables are intensity of light upon the street, brightness of street surface, visual angle between lamps and street surface, contrasts produced on street surface and on objects, portion of total field of view which is illuminated, and appearance of installation and street by day and by night. As a part of this discussion illuminating-efficiency values for several modern street illuminants are given. The appendix includes statistics and photographs of some very recent installations which illustrate the latest trend in street lighting.

The paper was discussed by H. W. Fisher, C. R. Underhill, G. H. Stickney, D. C. Jackson, H. L. Wallau, W. R. Moulton, H. H. Magdsick, W. H. Pratt, J. B. Whitehead, Peter Junkersfeld, C. L. Dawes, A. T. Baldwin, L. D. Nordstrum, and H. V. Bozell.

Mr. Stickney referred to the lack of agreement on street-lighting problems, as to both ends and means. Mr. Millar had called attention to certain points, and added an important step to the ultimate solution. He referred to the competition between large and small units and said that intermediate sizes are often preferable. Different portions of the same street sometimes need different treatment. Undue weight has been given to efficiency because it is easy of measurement, but other elements, such as appearance, are entitled to consideration.

Professor Jackson said that the inclosed arc lamp was one of the mistakes of electrical engineers and he was glad to see other types supplanting it.

Mr. Moulton showed lantern slides of street lighting in Baltimore, substantiating some of the author's points. He emphasized the advertising value of profuse illumination. He also showed views of monuments lighted by concealed lamps.

Mr. Magdsick displayed lantern slides of street lighting in Cleveland.

Dr. Whitehead referred to the discomfort of exposed high-intensity sources, even where diffusing globes are used, and made a plea for concealed sources.

Mr. Junkersfeld referred to the complaints made in Chicago by residents who had powerful units placed in front of their houses, and the provisions made for shading the lamps on the

house side. These lamps are 25 feet high. Small units at lower mounting heights are often more satisfactory. Many compromises are necessary in street lighting, because considerations other than the best illumination are involved.

Mr. Baldwin referred to the change in candlepower of flame arc lamps due to etching of the globe and the deposit from fumes. The latter tends to give a better distribution of light. The effect of etching is not over 10 per cent. White flame carbons show a slight increase of candlepower with age, but not enough to counterbalance the decreases from other causes.

Railway Session.

At the session on Thursday morning six papers were presented dealing with contact systems of electric railways and all were discussed together. These were: "Unprotected Top-Contact Rail for 600-Volt Traction System," by Charles H. Jones, presented by D. C. Jackson; "Third-Rail and Trolley System of the West Jersey and Seashore Railroad," by J. V. B. Duer; "Contact System of the Southern Pacific Company—Portland Division," by Paul Lebenbaum, presented by R. F. Monges; "Construction and Maintenance Costs of Overhead Contact Systems," by E. J. Amberg and Ferdinand Zogbaum, presented by Mr. Zogbaum; "Contact System of the Butte, Anaconda and Pacific Railway," by J. B. Cox; "Contact Conductors and Collectors for Electric Railways," by C. J. Hixson.

Top-Contact Unprotected Rail.

The paper treats of the various factors which enter into consideration in the design of a 600-volt contact-rail system. The weight of rail to be used depends upon conditions met with in each case, but in general, a heavy rail is preferable from all points of view. The question of quality is rather indeterminate, but in general, it is not advisable to use soft steel until the weight has been brought up to at least 80 pounds per yard. Consideration should be given to it above this weight. Insulating and supporting is a mechanical problem which must be decided upon local conditions. The method of bonding and jointing to be used depends upon size and section of rail used. Provision must be made to control the expansion and contraction of rail by cutting it into sections and anchoring each of these sections. Various methods of connecting rails are described. The costs of constructing a single track mile of contact rail using 50-pound rail is $3,284, while the cost of the same amount of 80-pound rail is $4,028. The average maintenance cost per mile of rail, exclusive of entire renewal, is $80 per mile per year.

System of the West Jersey and Seashore Railroad.

The paper recites the details and cost of construction of the contact systems as originally installed and subsequently modified and extended, including third rail, third-rail insulators, protection, joint and cross bonding, track bonding and trolley structure. Operating experiences, as creepage of third rail, sleet formation on third rail, deterioration of rail bonds and detentions to train movements chargeable to failure of these structures, are related. The cost of maintaining the various contact structures for seven consecutive years, in cost per single track-mile per year, is presented. Results of actual measurement of third-rail and track resistances are also given.

Contact System of the Portland Division.

The paper describes in detail the overhead contact system of the electrified lines of the Southern Pacific Company, Portland Division, which operates at a potential of 1,550 volts. The design and materials of construction are given in considerable detail, and the cost per mile, of material and labor, is tabulated in very complete form.

Construction, Maintenance and Cost of Overhead Contact Systems.

The first part of this paper, written with special reference to the New Haven electrification, gives a brief analysis of the system and points to be considered in equipping trunk lines with overhead catenary construction. A short description is given of the various catenary types used on the New Haven, stating the conditions for which each is best adapted. The same applies to the supporting structures and sectionalization. The cross-overs and river crossings have been considered more fully.

With reference to the cost data: It should be borne in mind that the figures given apply to the New Haven construction which was installed in the section with greatest traffic density, also through thickly settled communities. Therefore, the figures given will be of little value for comparison or estimating unless these conditions are equated.

A general review of the problems involved in the maintenance and the cost of an overhead contact system of the catenary type, carrying high-voltage currents, is given in the second part. The paper includes not only the contact system itself, but the transmission lines which form an integral part of the same. The subject treated is the catenary construction on the New York, Westchester & Boston Railway which is purely an electrical line, having no steam whatever. The method of maintenance, the organization of the maintenance forces, the efficiency of insulation and other points which may be used in comparison and in discussion are brought out.

Contact System of Butte, Anaconda and Pacific.

A careful study of the general conditions existing on the railroad indicated that an overhead contact system was advisable. The relatively large amount of energy required per locomotive unit made the adoption of the roller pantagraph desirable. The weight of this type of collector demanded that the trolley line be made as flexible as possible. Special hangers, pulloffs, etc., were designed to accomplish this result. The cost of the contact system was relatively high because of the unusual conditions. The operation is quite successful, though some minor troubles were experienced in the beginning.

Contact Conductors and Collectors.

A general classification of collecting devices is given corresponding to the existing Institute classification of contact conductors. Contact rail systems and contact wire systems are considered along with their corresponding collectors. Many data derived from measurements made upon different types of overhead and collecting devices are arranged in the form of curves. The applications of these are discussed and the possibilities indicated for selecting other curves to still further express the factors essential to proper collection. This method of attacking the problem is a novel one and it is hoped that those interested in furthering the cause of better collection will be encouraged to assist in making further measurements. Examples are given of constructions where consideration has been given to the factors discussed. Suggestions are made as to profitable subjects for discussion.

These papers were discussed by L. D. Nordstrum, G. H. Hill, H. M. Hobart, R. L. Allen, D. D. Ewing and D. C. Jackson, as well as the authors of the papers. Mr. Hobart described the form of protected third rail and contact shoe being installed on the Lancashire and Yorkshire Railway in England, by J. A. F. Aspinall, the engineer.

On Thursday evening there was an illustrated lecture on the Baltimore and Ohio Railroad, by W. E. Lowes, assistant passenger agent, followed by an experience meeting of the Section delegates, presided over by H. A. Hornor. Before the latter was started, the services of Farley Osgood in staging the entertainment features were recognized, the presentation being made by H. W. Flashman. On behalf of the men a (china) home plate and fly swatter were presented and on behalf of the ladies a watch (alarm clock) and chain (dog leash).

Electrical Measurements.

At the session on Friday morning the first two papers were presented and then discussed together. These were "The Phase Angle of Current Transformers," by Chester L. Dawes, and "The Calibration of Current Transformers by Means of Mutual Inductances," by Charles L. Fortescue.

The Phase Angle of Current Transformers.

A method of testing the phase angle of current transformers by comparing readings obtained on a wattmeter whose current circuit is first connected to receive a part of the primary current (the remainder of the primary current passing in shunt through resistance) and then connected to the secondary circuit; the potential circuit is supplied from the primary voltage, and capacity or inductance is used to give the effect of a low power-factor in the wattmeter. Corrections are applied for the error of phase of the part of the primary current which passes through the wattmeter, and separately for the error of phase in the primary caused by the fact that the primary current is not exactly in phase with the voltage used to supply the wattmeter. A second method of connection is suggested which avoids the latter correction, and other methods including the use of a three-phase circuit are discussed. Results of tests are given, and also check obtained by the use of an alternating-current potentiometer. The method requires only portable instruments.

The Calibration of Current Transformers by Means of Mutual Inductances.

Reasons are given for the selection of mutual inductances as a means for calibrating current transformers, the most important of which is the wide use to which they may be put besides the calibration of current transformers. The design and manufacture of the apparatus is described, reason being given for the choice of the form of the secondary coils of the mutual inductances, which is a uniformly wound ring, and of the material used for the core, namely marble. The formula used in calculating the values of mutual inductance is given and its limitations stated. Variations in physical dimensions are given and errors in calculated values discussed. The method of calibrating the mutual inductances is described, which illustrates also one method of using the apparatus for measuring mutual inductance. The method of measuring ratios and phase-displacements by means of the apparatus, and the merits of various instruments for obtaining a balance are described and discussed. An artificial method of loading the transformers under test is proposed. Its advantages are pointed out. The use of the apparatus for measuring mutual inductance, self-inductance and alternating-current resistance is described. In conclusion it is stated that the apparatus has been satisfactory, and has given little difficulty in manufacture.

The discussion was opened by G. A. Campbell, who referred to the wide applicability of Mr. Fortescue's method, which has the desirable quality of being a zero method. He had tried the method, and at telephone frequencies the measurements can be quickly and easily made. For ordinary frequencies he suggested the use of two dynamometers, with the current in the fixed coil of one in phase and of other in quadrature with the test current. This would shorten the time required for a balance. The primary windings of the inductance coils should consist of two layers wound oppositely or other means taken to make them completely free from outside influence.

L. W. Chubb pointed out that the apparatus proposed is suitable for the shop and is used regularly in the transformer test department. Its usefulness is not confined to the laboratory.

C. H. Sharp praised the paper, but questioned the need of mutual inductances whose values can be calculated. The use of the synchronous reversing key made the apparatus suitable for the shop. The vibration galvanometer is not suitable for such work. Referring to the paper of Mr. Dawes, he said the method was a good one, but limited in its application.

J. R. Craighead said that a means of testing transformers in place was needed, and the method of Mr. Dawes permits it with the same instruments in the secondary circuit. The necessary corrections, however, would not always be easily applied. It requires careful handling, but is a good and practical method. Referring to the paper of Mr. Fortescue, he compared the two methods, using shunts and mutual inductances. The latter had the difficulties of a large number of contacts to be kept in order, and the danger of interference from stray fields. The author had eliminated the second difficulty, making the method much more desirable. The effect of varying wave form is different in the two methods, the shunt method being preferable in this regard, although this point is not important. The mutual-inductance method is better suited to the shop. He suggested the use of a separately excited dynamometer.

L. T. Robinson suggested a practical way of handling wattmeter corrections so as to avoid any confusion between positive and negative corrections.

C. W. Bates did not consider the method of Mr. Dawes as accurate as the agreement of results would indicate.

In closing, Mr. Dawes stated that the current in the secondary need never exceed five amperes, so that instruments of large capacity are not needed. The loading of transformers is not changed during a measurement. He uses a Sumpner dynamometer, which is sensitive, yet rugged.

Mr. Fortescue agreed that the use of two dynamometers would be an improvement. The errors with distorted waves are very small. If a separately excited dynamometer be used, one must be careful to avoid a distorted wave; using current from the same source where possible. One application of the mutual inductances is to measure the losses in power-limiting reactances.

A paper by V. L. Hollister, entitled "The Induction Watt-Hour Meter," was then, in the absence of the author, presented by M. G. Lloyd.

The Induction Watt-Hour Meter.

This paper discusses the principles and theory of operation of the induction watt-hour meter. It is claimed that the action is not due to a rotating magnetic field, as in the ordinary induction motor, and experiments are cited to prove this, among which is the fact that synchronous speed is not obtained. The need of compensation and its attainment are considered and an analysis made of the effects of frequency, temperature and wave shape upon the performance. Only temperature is found to have an effect and this is partly neutralized.

This paper was discussed by W. H. Pratt, A. S. McAllister, Chester L. Dawes, D. D. Ewing, C. W. Bates and M. G. Lloyd. Mr. Pratt maintained that there was no essential difference between a revolving magnetic field and the waves of flux passing over the surface of the disk, and others spoke to the same effect. In considering the effect of temperature, the element which is most important, because unbalanced, was not considered. Similarly with frequency and wave form, the analysis was incomplete the factors which really determine behavior not being considered. Tests on these effects show results differing with different types of meters. The author's assumptions are not even approximately correct. Mr. Dawes explained the meter action on the induction-motor principle, and showed why synchronous speed is not attained.

John P. Minton then presented a paper entitled "An Investigation of Dielectric Losses With the Cathode-Ray Tube," the discussion being carried over to the afternoon session.

Dielectric Losses With Cathode-Ray Tube.

This paper discusses the theory of the cathode-ray-tube wattmeter and shows how it can be used to determine directly the power-factors of insulations. The current and voltage are measured independently so that the dielectric losses in insulation can be calculated. Such measurements can be made up to the breakdown voltage of the material being tested. The development of the cathode-ray tube and its auxiliary apparatus is discussed. Measurements of dielectric losses, power-factors and currents, for varnished cloths and oil-treated pressboard, are given. The measurements have been made at 60 cycles at different voltages, temperatures, and moisture contents in the case of pressboard. Curves are given showing the losses, power-factors, and currents plotted against voltage, temperature, and per cent absorbed moisture. Empirical equations are derived for all the curves. It is shown that watt losses may vary from the 1.32 to the 2.52 power of the voltage. The losses and currents can be expressed by an equation of the form; $K_1 + K_2 Y^n$, where Y may be temperature in degrees centigrade or per cent absorbed moisture. The same form of equation holds for the power-factors up to about 85 per cent. The equations given show that the exponent n may vary from about four to seven, depending on the conditions of the tests and on the nature of the insulations. The large and harmful effects of moisture are clearly shown by the results, and the weakening effects due to high temperature are of much importance.

H. W. Fisher opened the discussion with a consideration of the losses in cables and the results he had obtained in testing them. He made use of a vibration galvanometer in this work and had found power-factors varying from 4 to 20 per cent. The sensibility was sufficient for a single thickness of insulation. Later a Rowland dynamometer was used for power measurements at high voltages. His tests on varnished cloth agreed with those of the author. With paper-insulated telephone cables, the results were quite similar to those obtained by the author on oil-treated pressboard.

C. L. Dawes presented written discussion prepared jointly with W. I. Middleton. He thought the author had underestimated the value of direct-current measurements. The resistance of cables drops with contined application of voltage, but the capacity does not change much. A wattmeter with

potential transformer was used by him, and results were considered accurate to 5 per cent, but the method was not applicable to such small specimens as used by the author.

F. W. Peek, Jr., discussed the mechanism of the losses in solid liquid and gaseous dielectric. Taking $p=afe^a$ as the expression for the power loss, either a or the exponent of e might be regarded as the variable. He gave values which he had obtained for the coefficients of loss at ordinary frequencies and said they agreed with values obtained by Alexanderson at high frequencies, up to 100,000 cycles. The loss in varnished cambric increases as the tenth power of the absolute temperature.

William C. Arsem pointed out the cumulative effect of heating in a dielectric, and the desirability of securing results with different thicknesses of pure materials, such as mica and glass. He then discussed the different theories of dielectric energy loss, giving preference to the ionic theory. He disapproved of the term "dielectric hysteresis" as a synonym for the energy loss. Both theory and experiment indicate that the loss is not exactly proportional to the theory.

Harris J. Ryan referred to the development of electrical measurements in general, and considered the present paper notable. He pointed out the advantages of the cyclograph, and its applicability to a wide range of frequencies. He had used it in corona measurements at 60 cycles and 180,000 cycles without any change of apparatus. There has been great improvement in the technique of the cathode-ray tube, and there is no longer any difficulty in insulating for any voltage, using the Fortescue-Farnsworth principle.

The paper was also discussed by A. S. McAllister, C. L. Fortescue, C. H. Sharp and C. W. Davis. In closing Mr. Minton said he preferred the mechanical commutator to excite the cathode-ray tube, although he had not had much experience with Dushman's kenotron.

After the conclusion of this discussion at the afternoon session, Professor Ryan was called to the chair and a paper was presented by Percy W. Gumaer entitled "Economic Operation of Electric Ovens."

Electric Ovens.

The energy losses in an electric oven may be divided into radiation and convection loss, preheating loss and the loss due to opening the oven door. Each of these losses was determined for several electric ovens and their effect on the cost of the cooking of various articles of food is discussed. With cheap fuels and inefficient stoves it matters little at what temperature a particular article of food is cooked if the results are satisfactory. With electric cooking, however, it is often several cents cheaper to cook an article of food at a particular temperature; for instance, with electricity at five cents per kilowatt-hour it is at least two cents cheaper to roast beef at 120 degrees centigrade than at 180 degrees. The results of the experiments performed indicate that for each article of food there is a particular time and temperature for which the cooking can be satisfactorily performed with a minimum amount of energy. The problem of the engineer in the further development of electric cooking is to design practical cooking devices in which the temperature can be accurately regulated with a minimum of attention on the part of the housewife and thus co-operate with the domestic scientist in the inauguration of truly scientific cooking.

The discussion was opened by D. F. Henderson, who said that the manufacturers had given careful study to the construction of electric ovens, but little attention had been given to the best conditions of operation. The cost is not excessive when properly used. He had used one for three years and found the cost for a small family not much different from the cost when using gas. The great drawback is in heating water, if this is not done in a systematic matter. A flat-rate water heater consuming 600 watts is now used. This is automatically disconnected when the range is switched on, so it operates about 18 hours per day and gives a continuous supply of hot water. Spokane has a block rate providing for three cents per kilowatt-hour for all energy above 30 kilowatt-hours, so that energy for cooking is obtained at three cents. There are about 100 installations in that city.

S. N. Clarkson said that a number of electric ranges had been installed in St. Louis, and they showed a good diversity-factor. The cost depends upon the individual operating the range, but is comparable with that for gas. A fair average is one kilowatt-hour per day per person.

H. L. Wallau said that in Cleveland, with energy at five cents, the average cost per month per person is between $1.50 and $2.00.

Ralph W. Pope, H. W. Flashman and M. G. Lloyd also joined in the discussion.

A paper by Frank G. Baum, entitled "Class Rates for Electric Light and Power Systems or Territories," was, in the absence of the author, abstracted by H. M. Hobart.

Class Rates for Light and Power.

The author offers arguments in support of the principle of establishing uniform rates throughout a system or territory for different classes of service. In establishing the rates he segregates the services into eight different classes and divides the rates into energy and demand charges; the energy charges being those charges which increase with the kilowatt-hours supplied and the demand charges being proportional to the peak loads of the different classes. By establishing similar rates for similar services throughout a territory any appearance of discrimination is avoided and a sliding scale of rates will take care of quantity consumption. The advantages are summarized as follows. Average class rates for the entire system (1) will tend to have "value of service" and "reasonableness of rate" given consideration when fixing rates; (2) will make one rate for entire district for one class and hence give advantage to company having the lowest cost; (3) will tend to reward the efficient company and hence tend to reduce costs of service; (4) will tend to allow constant service value of the property of the system as a whole; (5) will very much simplify rate-making; (6) will remove the differences in rates which cause most dissatisfaction and cause most rate inquiries; (7) will tend to make rates stable over a period of years.

This paper was discussed by William J. Norton, H. L. Wallau, M. G. Lloyd, S. N. Clarkson, W. H. Pratt, E. L. Wilder, J. W. Welsh, H. M. Hobart, and Ralph W. Pope. Mr. Norton said that an intense study of rate-making had been going on in California during the past year, and the state commission there was finding its theoretical basis of rates impracticable. Rates cannot be made on a pure cost basis. Rate-making is an art and not a theory, and rates should be simplified as much as possible.

Mr. Wallau took issue against a straight energy rate for each class. He believed in a quantity discount within the class. There are three general rates in Cleveland, the residence and general commercial schedules being based on the Wright demand system, while large power users came under the Hopkinson system, with discounts for quantity. This is satisfactory, but it is hoped some day to frame a single schedule which will cover all users by properly considering load-factor and other elements. He cited an example where a customer with poor load-factor earned a better rate on account of large consumption than when his load-factor was better.

Mr. Clarkson said that the paper seemed to apply particularly to California conditions. Certainly charges should not be the same at the two ends of a transmission line, and local costs should be considered, as the author admitted. Small differences in generating cost are unimportant, as this is a small item in the total charge. It should be emphasized that the central station is selling service.

Mr. Wilder thought there should be some incentive in the rate for the consumer to improve his load-factor.

Mr. Welsh said that the class load-factor is taken care of in the author's scheme, the principal feature of which was to prorate the demand charge.

Mr. Hobart agreed in the main with the author, but thought that such elements as power-factor should be considered.

The convention then adjourned.

Electricity in the War.

Electricity plays quite an important part in the present war operations, in the fields of electric lighting, especially for searchlight use, electric motors, telegraphy and telephony, and wireless telegraphy.

One important use is seen in the numerous types of automobiles or other portable plants containing gasoline motors and dynamos, and in this way there are now on the field many such outfits which serve for the uses of electric lighting, wireless telegraphy, portable repair shops for aeroplanes, water-purifying plants, and other purposes. Electric apparatus is mounted upon aircraft in the way of searchlights, wireless-telegraphy outfits, and the like.

The use of the electric motor in connection with a large power van of the gasoline type allows of designing a well organized traveling tool shop in which the van contains motor-driven machine tools. The French army makes use of an automobile repair shop for aeroplanes which is shown in one of the photographs. According to the method used by the army in the period preceding the war, aeroplanes are grouped in sections or fleets containing six or eight aeroplanes each, together with automobile convoy wagons for transporting them upon the road. The electric-motor-driven tool-shop van is a very necessary feature of the fleet and accompanies it along the road. The fleet proceeds over the routes, preferably at night, and is then stationed at its camp which serves as headquarters for making the flights for reconnoitering the enemy's lines or for other operations. Each camp thus has its repair shop, and this is most useful in keeping the aeroplanes in active service and preventing them from being laid up through accidents which may happen to them when on flights. Even though an aeroplane is considerably damaged, it can be put into shape within reasonable time; motors can be replaced, etc., from the stock of material which is carried upon power wagons along with the fleet. It will be seen that the present method is most effective in keeping the aeroplane fleet in good working order, and the electric motor is largely responsible for this, owing to the readiness with which the machine tools can be driven, and the work can be well lighted with electric lamps at the same time.

Fig. 1 shows a repair outfit which is built by one of the principal Paris automobile works, the De Dion Company. Although closed tightly when on the road, the van opens up by letting down a large flap door at each side, and this being held horizontally upon props, serves to greatly increase the floor surface of the repair shop. There is also a double door for entering the car at the back end. Inside the shop are installed various tools, such as lathes, emery grinder, etc., which are driven by small electric motors. Good-sized work benches are provided, and a good set of metal-working and wood-working tools for making all kinds of aeroplane repairs. The stock of material and spare parts is carried for the most part upon special supply automobiles.

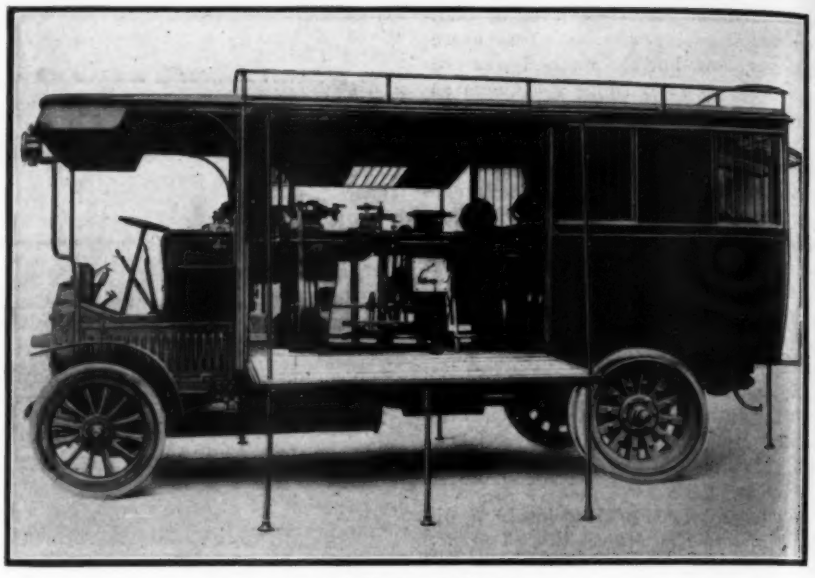


Fig. 1.—Auto Repair Car.

A 25-horsepower motor of the usual gasoline type serves not only to propel the car but also to drive a good-sized dynamo. This latter gives what current is needed for the various electric motors and also for the electric lighting, so that repairs can be carried out night and day. Electric lamps are mounted inside the car on the ceiling or elsewhere, and extension cords can be used outside, for a number of the appliances, such as a forge, are set up on the ground as being most convenient. When thus organized, the aeroplane fleet with its various power cars accompanied by the automobile repair shop, is quite independent, and can start out at all times to follow the troops on the march. It is able to camp at any chosen spot, and no sheds of any kind are needed.

Fig. 2 shows an automobile repair shop which is similar to the above in its general lines and conforms to the army standard, but it has a number of differences in detail, such as the disposition of the machine tools inside the van. The automobile is built by the Paris Crochat-Colardeau works, and the chassis is here operated on the gasoline-electric drive. In this type a

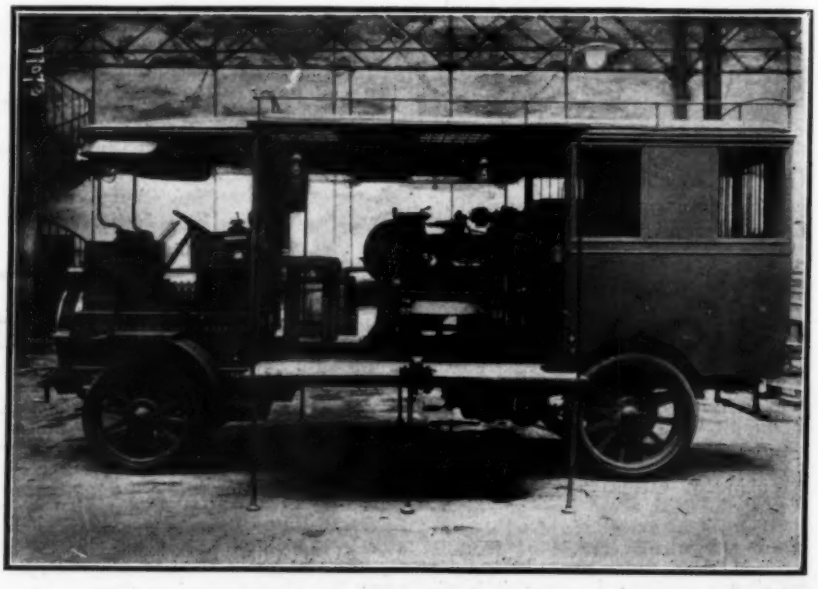


Fig. 2.—Auto Repair Car.

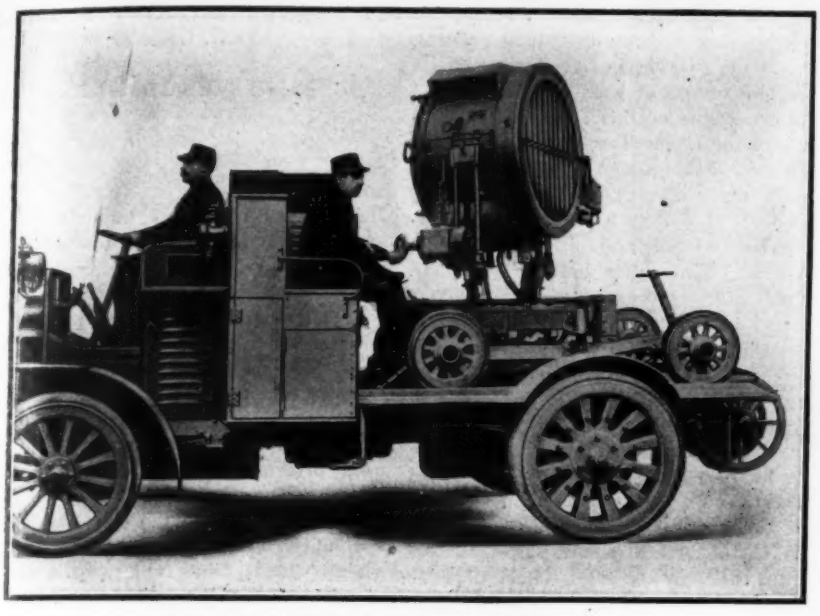


Fig. 3.—De Dion Auto Searchlight.

24-horsepower gasoline engine on the front of the truck is coupled to the shaft of a generator on the usual plan, and the current goes through a controller to two electric motors in the rear. Each motor drives one of the back wheels by reduction gearing, speeds being changed as usual by the controller. Four controller positions are used, allowing for motors in series, in parallel, electric brake and back drive. Speed changes for closer working are secured by operating a pedal which regulates the gas inlet to the engine, and the car can also be started and stopped by the same pedal.

The French army is making use of an automobile searchlight outfit which is the joint product of electrical engineers and the De Dion automobile works. The back part of the power-wagon chassis is laid out so as to allow of mounting the electric searchlight in a suitable manner, this being a separate and complete makeup which consists of a small truck with rubber-tired wheels and holding the searchlight, this being of the usual arc projector type. Placed upon a pair of side rails when on the automobile, the searchlight truck can be readily unloaded off the back end of the car, as shown in Fig. 4. The object of this design is to be able to use the searchlight upon the car itself when this is running on the road or stationed at any suitable point, and to allow the projector apparatus to be removed and run out several hundred feet from the car, should this be necessary. It may often happen that the automobile is to be stationed on the road, while the searchlight is taken over ground where the car could not follow and there set up for projection work in lighting up the enemy's positions. A dynamo is operated by the car engine in order to furnish the current.

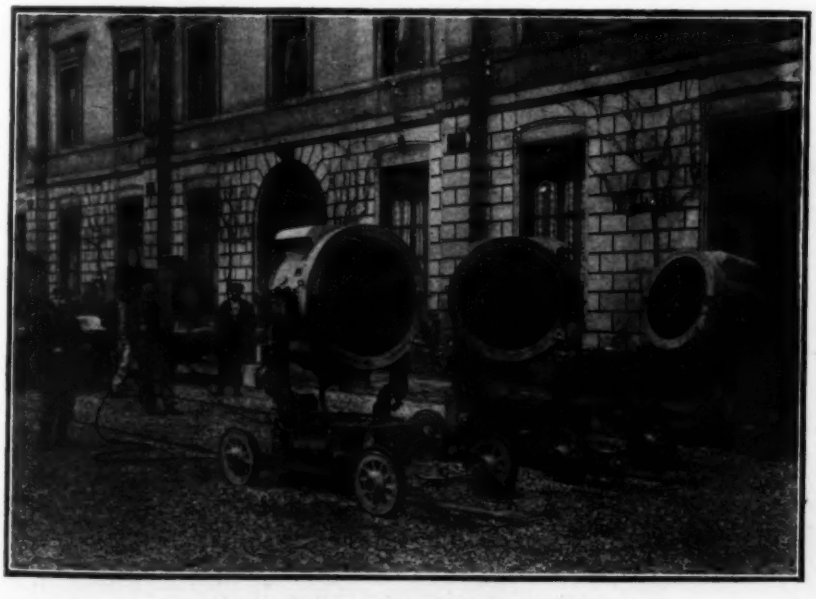


Fig. 4.—Battery of Portable Searchlights.

In the base of the searchlight is placed an elaborate apparatus, including small motors and sets of relays, in order to operate all the movements of the projector by electric control. This is especially valuable where the searchlight is removed to a distance from the car, being connected with the automobile by a cable. The operator holds a small controller in his hand, which connects, by separate wires within the same cable, to the electric mechanism within the base of the searchlight, and in this way he can remain on the car and direct the searchlight's movements from a distance, or can be stationed at other points. This is desirable, because the operator could be blinded by the light if he stood too near the beam in order to direct it, and it is preferable that he should be placed at some distance away.

Electric searchlights are now coming into use in aviation grounds, and are likely to prove very valuable for use with aircraft. The apparatus is often mounted on the roof of the building or in other cases at different places on the grounds, and it seems to indicate to aeroplanes or airships the position of the grounds and the best point for making the landing, as well as showing the name of the station. For this latter use an eclipse device is provided so as to make the required Morse signals. The searchlight is also very useful in making night ascensions by aircraft. In some cases it is preferable to to have a wide angle or diffused beam which spreads out considerably, but for other purposes a narrow and concentrated beam is wanted. For instance, when it is required to explore the horizon in order to show up airships or aeroplanes of friend or foe. Here the optical devices give the greatest possible concentration to the beam, so as to have it carry to its farthest limit. At the same time the apparatus is easy to work so as to direct the light by a rapid sweep all around the sky. Again, such a projector is excellent for showing up the premises of the station in a strong light so as to allow aeroplanes to make a landing at night under the best conditions. Usually such apparatus is kept in a horizontal position, and a large mirror in front serves to reflect the beam upwards or in various directions. It is not advisable to turn the searchlight itself up to the sky, for particles of incandescent carbon would thus fall on the surface of the mirror and cause damage.

Searchlights for vessels are, of course,

largely used in the present operations. In this class there is a somewhat unique type of German searchlight, which has a single projector, but is designed to throw a double beam of considerable power. The object of this makeup is to provide an apparatus which is more suitable for use on ship canals than the more common single-beam projector, for under such conditions it is found that the beam which one vessel may throw onto a second vessel has the effect of a blinding light upon the crew, and this is a drawback for obvious reasons. The use of a double beam is found to give a great advantage for canal work, for in this case both banks of the canal are lighted at once without having to shift the apparatus, and at the same time the beam does not strike other vessels in the line of the canal.

Among the numerous types of electric searchlight equipment which are in use in the war may be noted a very useful one which is brought out by a Berlin establishment. It consists of two separate parts, first a portable electric plant with gasoline engine, which can be used for various purposes either for field searchlights of various kinds, or again for any purpose where current may be needed. The second part of the outfit consists of a searchlight mounted on tripod base, this being well adapted for campaign work for lighting under various circumstances. One very efficient use for this type of searchlight is for optical signaling by means of flash signals.

On the light two-wheeled truck is mounted the electric plant in the shape of a gasoline engine direct-coupled to a small generator. The engine is water-cooled, and the radiator is mounted on the front end. Flaps can be let down all around, so as to protect the apparatus against dust or rain. Two men can readily handle the present apparatus, and it can be quickly transported over the road.

Electric methods are being applied with success for purifying water for the troops, both for antiseptic surgical work and for supplying drinking water to the soldiers. Such outfits are very valuable for use in the field in regions containing polluted water, and often prevent typhus and cholera, as well as other diseases due to such sources. The electric method is a most efficacious one from the fact that by its use the most polluted water can be treated so as to be made quite pure and free from disease germs. Two widely differing methods are employed for sterilizing, one of these being by the action of ozone in the Schneider automobile apparatus which we recently described. A second apparatus, also of French make, is used in which the water is sterilized by the action of ultra-violet rays from a quartz mercury lamp, this method having been developed by Prof. V. Henri's researches at Paris. It has the advantage of great simplicity, and an apparatus of this kind can be contained in a small road wagon. The present makeup consists of a double train of artillery type having a front two-wheel wagon box for holding various material, and drawing a rear wagon. This latter holds a complete small gasoline engine and dynamo plant by which current is sent through cable to the separate water-treating tank mounted on a tripod. Together with the motor group there is a water pump and a filter. A hose of 20 feet or more length takes up water from the source at hand, sends it through the rapid filter and into the white enameled tank of the sterilizer, where it is brought under the action of the powerful rays from the mercury-vapor lamp. This is mounted in the upper part of the tank and just above the level of the water. Means are provided so as to make the water circulate actively within the tank, so as to bring all its parts under the influence of the rays, and it is found in practice that all disease microbes are very effectively killed in this way. Around the base of the tank are placed numerous taps for taking off the water by the soldiers.

A very efficient wireless telegraphy outfit for use in field work is the new Marconi cavalry pack. The outfit is made up in several parts of comparatively light weight, so as to be readily transported on horse or mule-back. On one side is the portable electric plant with gasoline engine and generator, which can be set up in running order in a very short time. An ingenious method is here used to allow of carrying the group and at the same time of coupling up engine and generator, employing a short section of coupling shaft which is fitted in when on the ground. This coupling piece is afterwards removed when the apparatus is to be transported, so that the saddle can fit upon the horse.

Production of Mica in 1914.

The value of the mica produced in the United States in 1914 was $328,746, a decrease of $107,314 from 1913, according to a statement of Douglas B. Sterrett, of the United States Geological Survey. The production came from 13 states. The output of sheet mica amounted to 556,933 pounds, valued at $277,330, as compared with 1,700,677 pounds, valued at $353,517 in 1913, and the production of scrap mica in 1914 amounted to 3,730 short tons, valued at $51,416, as compared with 5,322 short tons, valued at $82,543 in 1913.

There was also a decline in imports of unmanufactured and trimmed mica.

THE ILLUMINATION OF GLASS FACTORIES.

By William A. D. Evans.

The glass industry in the United States produces yearly products valued roughly at $100,000,000. This is divided almost evenly between building glass, pressed and plate glass, and bottles and jars.

Of the building glass the major portion now made is known as plate glass, which embraces all of the ordinary glass used for window work, store fronts, etc. Glass made under the trade name of "window glass", however, is not used for windows but is used principally for mirrors and the covering of pictures. This form of glass is blown in cylinders and then cut open and flattened, while plate glass is flowed onto tables of the proper size and rolled to the desired thickness, then annealed, ground and polished.

Due to the fact that this glass when finished must be free from air bubbles and be highly polished, it is most essential that during the entire process of manufacture the different operations be adequately and properly lighted. The different steps in the manufacture of plate glass and the method of lighting them in a modern plant will be described.

The first operation is the melting down of the raw materials, or the "batch", as it is called. In the modern plant here described this is done in a furnace room where there are nine furnaces, each furnace containing 16 pots. It requires about 14 to 15 hours to heat the pots for casting. Each pot has a capacity of 285 square feet of glass or approximately 2 to 25 tons. After the batch has been properly melted, the pots are lifted from the furnace by means of cranes and the molten glass is flowed onto casting tables. These casting tables are about 16 feet wide by 30 feet long. The edges are built up so as to keep the molten glass from running over and to flow the glass to the desired thickness. As soon as the glass is flowed onto the tables it is formed into shape by rollers which run back and forth until the glass becomes hard. The lighting of each of these tables is accomplished by means of two mercury-vapor lamps.

From the casting tables the glass goes to the tempering lehr where it is put through the annealing process. The lehr in this plant is 190 feet long and the glass plates are taken from the casting tables and put in at one end of the lehr, where the temperature is maintained extremely high and the glass travels through at a very slow rate of speed, the temperature of the lehr gradually lessening as the glass

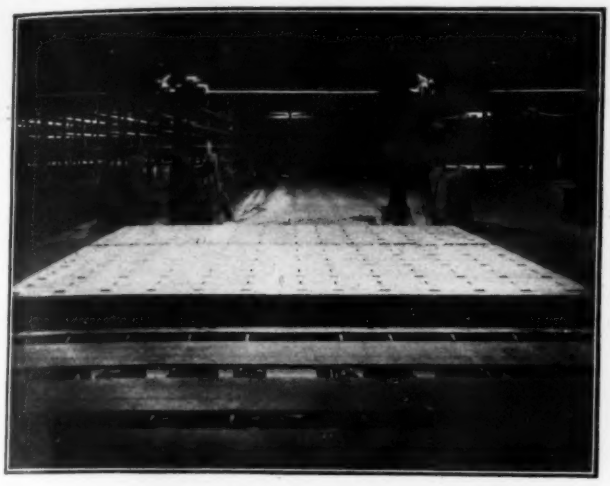


Fig. 1.—Cutting Table at End of Lehr.

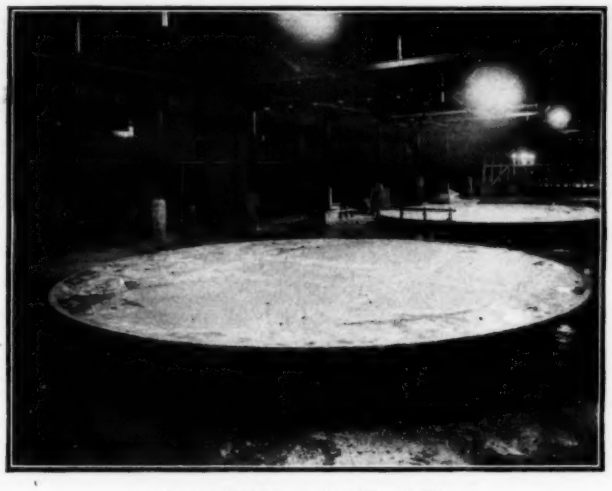


Fig. 3.—Tables in Laying Yard.

passes along. At the other end of the lehr from where the plates enter is the cutting table, which is about 16 feet wide by 24 feet long. Fig. 1 shows a typical cutting table, which is lighted by two lamps similar to those used over the casting tables.

It is very essential at this part of the process that the men who handle the glass be able to detect all bubbles, checks, vents and defects, as the glass is now cut to eliminate all flaws. It is most important to see the vents around the edges of the plates. If the vents are not seen before the glass is removed from the table to an upright position, the strain started by the vent usually breaks the glass.

Before the use of mercury-vapor lamps the cutters at the lehr were unable to see many flaws which should have been cut out and which were not detected until the final inspection. This glass then finally had to be graded as seconds. With the use of the mercury lamps at these tables, it was very soon noticed that the seconds had decreased materially. This is due to the peculiar color of the mercury-vapor lamp, which enables the eye to focus for one color of light and thus make detail stand out more sharply. In other words, the men could see the scratches more clearly, as by this light they were seemingly magnified, thus providing for an easy detection of all flaws. It is essential that the glass be cut to as large plates as possible, naturally eliminating the flaws. In this plant the largest plates which have been made are 175 by 286 inches.

After the glass has been cut, it is taken to the rough racks. There are 28 racks similar to those shown in Fig. 2, each of which is 50 feet long and lighted by one mercury-vapor lamp. From the rough racks the glass is moved to the laying, calking and joining yard where the plates are laid on the tables similar to those shown in Fig. 3. These tables are mounted on wheels. The tables are about 36 feet in diameter, weigh about 75 tons and each one holds approximately 900 to 950 square feet of saleable glass.

In laying the plates on the tables, they are fastened by means of plaster of Paris and the edges joined together. All of this work is done in the left-hand side of what is known as the main building of the plant, which is 192 feet by 975 feet long of monitor construction. The center bay is 45 feet wide and is equipped with a track for transferring the tables. Fig. 4 shows a view of this building.

On the right-hand side of the building are built in five grinding machines and six polishing machines. Each of the grinders is operated by a 500-horse power motor and run at a speed of about 21 revolutions per minute. The tables with the glass on them are run from the laying yard and transferred to the grinding machines where the grinding is accomplished by disks which rub off the surface of the glass by means of sand. The process first starts with course sand which is gradually reduced, finally being finished with very fine sand. This process requires about one hour.

After grinding, the glass is taken to the middle yard where it is inspected and joined again. After this it is sent back to be polished.

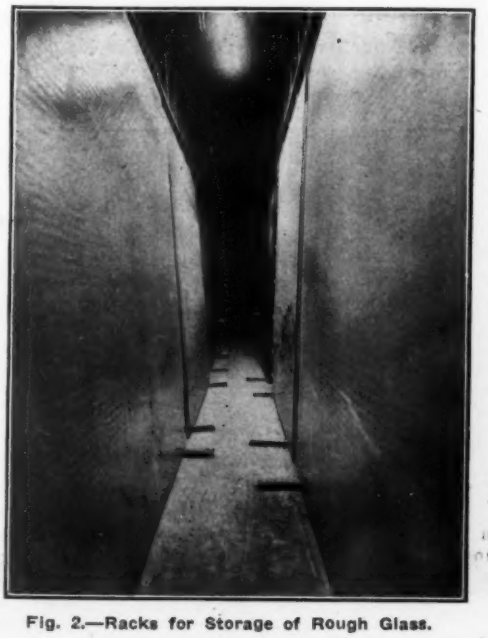


Fig. 2.—Racks for Storage of Rough Glass.

Fig. 4.—Grinding and Polishing Tables.

Fig. 5.—Tables in Stripping Yard.

Fig. 6.—Manner of Inspecting Plates.

The polishers are operated by 600-horsepower motors and the table speed in this case is about 16 revolutions per minute. It requires about two hours to polish the glass properly. The disks on the polishers are covered with felt about one inch thick and rouge is applied automatically. The lighting of the grinding and polishing tables is accomplished by mercury-vapor lamps placed about 22 feet from the floor, approximately one to a table. The lamps are placed high as in the grinding a great deal of wet sand is thrown up by the spray from the machines.

After the glass has been ground and polished, it is transferred back to the opposite side of the building or to the laying yard where the sheets are taken off and turned for the grinding and polishing of the opposite side and the same process is followed out.

After the final polishing, the glass goes back to the stripping yard. A portion of this yard is shown in Fig. 5. Here the glass is removed from the tables, washed and placed on tables for moving to another building for inspection, which consists of grading according to size and quality. The inspection and cutting is all done in the warehouse building, where the glass is also packed and shipped. The inspection is carried on by hanging the plate glass in a vertical position and looking through same carefully for flaws. In this case a mercury-vapor lamp is placed behind the glass on 25-foot centers. The walls and tables are all blackened and the windows are covered with black shades to keep out strong sunlight, the entire light for the inspection being furnished by the lamps. Fig. 6 shows the manner of inspection.

It was a frequent occurrence before these lamps were installed that a table would be taken from the polisher after it had been running for two hours, the glass on which had not been sufficiently ground and then had to be joined again and reground before it could be polished. This was due entirely to the inability of the inspectors to see scratches, owing to the poor quality of the old lighting system. An inspector who had twenty years' experience at the work said there is no doubt that for this class of work the mercury-vapor light is much better than daylight. This is due to the high acuity of vision under the monochromatic light of the mercury arc.

The increased saving effected by these lamps throughout the different processes can readily be imagined. The cutters at the lehr use the lamps day and night and are able to cut the plates to eliminate all flaws, but before these lamps were used many defects were not found until after 10 operations, including the washing. They were then discovered after final inspection and it was necessary to grade and sell the glass as seconds. The time, labor and power that is saved by the inspectors being able to tell without much effort or eye strain that the glass has been properly ground or polished is enormous. Many extra operations are eliminated and many serious accidents prevented due to this system of lighting.

Besides the ability of the inspectors to see scratches owing to the acuity value of the light, another marked advantage noticeable is that on account of the low intrinsic brilliancy of the

Fig. 7.—Packing and Shipping Department.

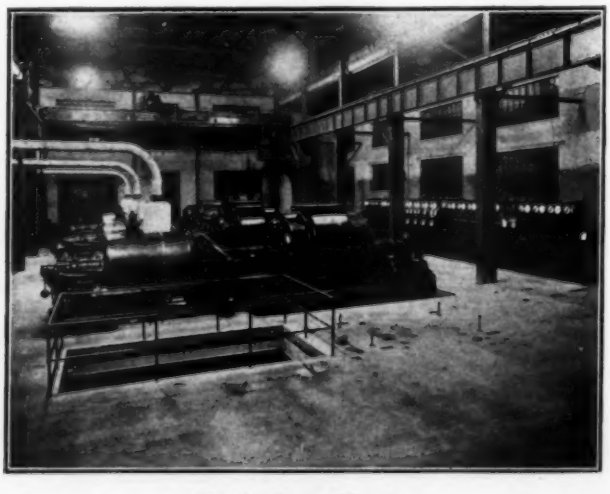


Fig. 8.—Power House.

lamp, the glare from the polished glass is markedly reduced; in other words, the reflection of brilliant light back into the eyes of the workmen, which occurs when a unit of high intrinsic brilliancy is used, is almost eliminated. This helps materially in increasing the speed with which the work can be accomplished.

From the point of view of the management, it is also worth a great deal to know that when a very large shipment of glass is to be made to a particular customer that they are going to be able to get the shipment out satisfactorily without any waste of time, due to not being able to eliminate flaws.

The packing and shipping department is shown in Fig. 7. This room is 60 by 130 feet and is lighted with 10 mercury-vapor lamps at a little less than 0.5 watt per square foot. The entire lighting load for this large pllant is extremely small.

A view of the power house is shown in Fig. 8. It is 77 feet wide by 136 feet long and is lighted by six mercury-vapor lamps suspended 32 feet from the floor. The equipment of this department consists of three 2,000-kilowatt turbines and one 200-kilowatt motor-generator set. The boiler house is 45 feet wide by 157 feet long and is lighted by means of five mercury lamps. It is equipped with eight 500-horsepower boilers.

The first lamps were installed in this plant about four years ago and there are now in service about 170 type P Cooper Hewitt mercury-vapor lamps in both the old and the new sections of the plant, which are in operation on an average of 4,000 hours per year.

Another interesting installation, using mercury-vapor lamps for manufacturing plate glass, is by the use of the type Z or quartz-tube lamps. Ten of these lamps are installed in a building 100 feet wide by 420 feet long suspended about 36 feet from the floor. Four of these lamps are used to light five 24-foot tables in the laying, joining and stripping yards. The cutting table at the end of the lehr is lighted with one lamp; one is placed over the rough racks, and the remaining four are used for lighting one end of the pressing, cutting, inspecting, packing and shipping departments and also the finished racks. These lamps are equipped with opalescent globes and the quality of light meets the requirements perfectly for this work. In this case the work is being done with an expenditure of energy of a little less than 0.2 watt per square foot.

Besides plate-glass manufacturing mercury-vapor lamps have been used in a number of bottle manufacturing plants. Here they are placed at the end of the lehrs for inspection. The lamps are also used in the cut-glass departments of some of the largest cut-glass factories, where they are lighting the cutting-wheel frames. The lamps used in this case are the alternating-current type lamps.

The experience of all these glass plants, that is, those for plate-glass, bottle and cut-glass manufacturing, has been that the mercury-vapor lamp, on account of its peculiar color value, which gives its particular seeing quality, and its low intrinsic brilliancy, which reduces the glare, proves better for these classes of work not only than any other form of artificial illumination, but also better than daylight.

LETTER TO THE EDITOR.

Exaggerating an Ordinary Electric Vehicle Performance.

To the Editor:

It is a matter of constant surprise to me that there appear so frequently in the newspapers, statements which although evidently inspired by the manufacturers of electric motor cars, nevertheless tend to belittle the possibilities of their own product. This is most frequently seen in accounts of runs made by electrics covering a very few miles at a very slow speed and yet heralded as wonderful performances.

One of the worst examples of this sort of thing is to be found in your issue of June 5, 1915, in an account of a "sociability run," covering the paltry distance of 40 miles, at the low speed of 15 miles per hour. This run is referred to as something that "may seem incredible," and as an "unheard of expedition."

To one who appreciates what the electric motor car really can do, and who has himself made time and time again much longer runs at very much higher speed, the account of the run seems to be the very worst possible form of publicity.

JOHN S. CODMAN.

Boston, Mass.

Wireless Receiving Devices Patented by Greenleaf W. Pickard.

Four patents for an oscillation-receiving device for wireless telegraphy have been issued to Greenleaf W. Pickard, of Amesbury, Mass. In the first patent, the receiving device has a member containing silicon with a contacting member containing metal antimony; in the second patent, the contacting member contains arsenic and antimony, in the third, metal bismuth, and in the fourth, metal arsenic.

Considerable progress is reported in the development of wireless fog-signaling apparatus, the perfection of which will greatly promote safety at sea during fog.

BOOK REVIEWS.

"Graphical Determination of Sags and Stresses for Overhead Line Construction." By Guido Semenza and Marco Semenza. Translated from the Italian by C. O. Mailloux. New York: McGraw-Hill Book Company, Incorporated. Cloth, 24 pages (8¾x11¼ inches). Supplied by the Electrical Review Publishing Company, Inc., for $3.00.

This volume is a mathematical treatment of the problems involved in determinating the sags and stresses in overhead lines. The text is supplemented by 13 charts, in which the results are plotted on cross-sectioned paper, these charts being of double-page size. The purpose of the work is to substitute for the rule-of-thumb methods, which have been used especially upon low-tension and less important lines, a method based upon rigorous application of the physical laws involved. The authors are specialists in transmission-line work in Italy, and the translator has given an excellent rendering. After considering the principles and the results obtained from them, explanations of the charts are given with examples of their practical use. In addition the necessary allowances for wind and ice conditions are taken up. This volume is invaluable to the transmission engineer who desires to base his work upon mechanical laws and apply them with precision. The charts enable the proper sag or tension for a given case to be found by inspection.

"Organization of Workshops and Factories." By Robert Grimshaw. New York: Published by the author. Paper, 95 pages (3½x5¼ inches). Supplied by the Electrical Review Publishing Company, Inc., for 50 cents.

This volume is an outline which may be followed in systematizing the work of factories and shops, and its brevity has limited it to little more than a skeleton, without any illustrative or concrete examples. The work is a syllabus of the lectures which the author has recently given at New York University and the Pratt Institute.

"Resuscitation." By Charles A. Lauffer, M. D. Second edition. New York: John Wiley & Sons, Incorporated. Flexible cloth, 90 pages (4x6½ inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc., for 50 cents.

This edition of the very valuable exposition of the Schaefer, or prone-pressure method of resuscitation, by Dr. Lauffer, has been somewhat enlarged. The advantages of this method are emphasized, as well as the necessity of non-professional men being familiar with its application. Readiness to apply the method will result in a saving of many lives which would otherwise be sacrificed.

New Electrical and Mechanical Appliances

Ornamental Porcelain Socket.

An attractive porcelain socket, designed particularly for use in bathrooms and other damp places where a porcelain socket is either required or desirable, has been placed on the market by the Arrow Electric Company, Hartford, Conn. This socket is known by the trade name Arrobell, suggestive both of its maker and shape.

Use of this socket dispenses with a special husk and also eliminates using a round glass diffusing globe, since the socket is specially suitable for use with standard frosted round-bulb Mazda lamps. The socket harmonizes particularly with the No. G 25 bulb and its round porcelain skirt

Arrobell Porcelain Socket.

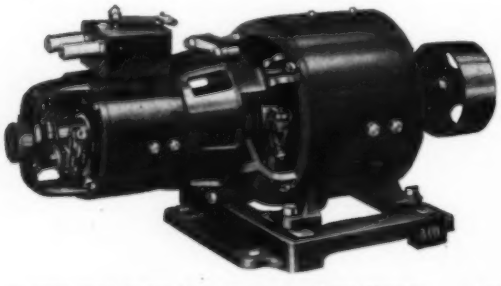
gives the effect of a white-enamel husk. The porcelain is a pure white, nicely glazed. This socket is interchangeable with quite a number of caps and bases.

Unique Generator Set for Country-House Lighting.

The steadily increasing demand for the conveniences of electric light in farm houses, country homes, summer resorts, etc., is calling for a variety of generating equipment in those places where the absence of electric service lines compels use of small engine-driven plants. Of such equipments, one of the most unique is illustrated herewith.

This outfit consists really of two generators mounted on the same shaft. The large machine is the generator proper which furnishes energy for the lights. The overhung machine is very much smaller and is used primarily as a starting motor for cranking the engine and, after the engine is started, it serves as a generator to charge a small storage which furnishes the current for the starting motor in cranking the engine the next time.

In this system no storage battery is used for the lighting or appliance load. Whenever light or current for some small motor or other appliance is desired at any point in the premises, a button is pushed which first closes (through a third wire) a circuit between the small storage battery and a solenoid. The latter closes the switch for the small starting motor, connecting it across the battery. The small machine then cranks the gasoline or oil engine. As soon as the engine begins to run on its own power it quickly speeds up and supplies lighting current from the main generator. The



Duplex Generator for Rural Lighting Plants.

entire starting operation takes only about 15 seconds or less.

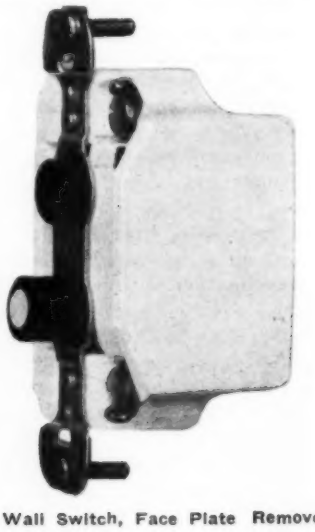
As long as the set is in operation, the little machine, which is designed for about six volts, continues to charge at a decreasing rate the three-cell battery for restarting.

The large machine is a standard 110-volt generator, so that current can be transmitted to the garage or other buildings at some little distance without great loss; use of this voltage also permits putting in standard lamps and wiring. The large generator can be either a direct-current or aternating-current machine. In the latter case, the small machine is made of sufficient capacity to act as an exciter for the alternator as well as to serve as a combined starting motor and charging dynamo.

Improved Flush Push-Button Switches.

Desirable improvements have recently been made by the General Electric Company in the design of its flush wall switches. The corners of the porcelain boxes have been rounded, making the binding screws more accessible and the boxes less liable to breakage when the switches are installed. The walls of the boxes have also been considerably strengthened without increasing the overall dimensions of the switches.

A fiber dust cover is now permanently attached, effectively closing all



Improved Wall Switch, Face Plate Removed.

openings to the mechanism but interfering in no way with the wiring of the switch. Adjusting nuts are furnished with each switch. This method of adjusting switches to outlet boxes is superior to the old-style washer type of adjustment. Holding-down screws are pointed, making it easier to locate holes in the outlet boxes and to enter the screws. These switches are made both single pole and double pole. The illustration herewith shows the single-pole type.

The Universal Lightning Arrester.

Central-station operating men have learned by experience that the ideal lightning arrester for outdoor service on overhead distribution lines, from both the cost and the service viewpoints, must not only offer an easy

path to ground for lightning or static charges while shutting off the flow of this path, that is, it must have a choke discharge, but it must have some means of forcing the lightning to take this path, that is, it must have a choke coil which will not permit the high-frequency discharge to pass the arrester. Furthermore, it must be troubleproof, it must have no moving parts or box to collect dirt, cause trouble and require frequent inspection and

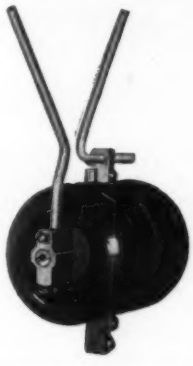


Fig. 1.—Universal Lightning Arrester.

repairs, and it must be mounted in such a way as to minimize the danger of the linemen's coming in contact with it or of its burning the pole during heavy discharges. Finally, to reduce the stock kept on hand, it should operate equally well on any circuit, whether arc, incandescent, power or transmission.

With these requirements in mind, the "Universal" lightning arrester was designed by the engineer of an eastern central-station company supplying a territory of about 800 square miles in

Fig. 2.—Reverse End of Arrester.

a mountainous country where lightning conditions are most severe. A long, 2,200-volt, single-phase circuit having a high mark of 16 transformer burnouts in a day and an average of several during each storm, was fully equipped with Universal arresters. During the following season there was not a single transformer failure. In another district, having 1,900,000 feet of 2,200-volt lines, which would require 950 arresters properly to protect it, 74 Universal units were installed, with the result that transformer burnouts were reduced from 150 per season to 40 per season. For the past three years the Universal arrester has been subjected to the hardest kind of service on this company's lines, and during this period the theories underlying its design have been thoroughly tested and every possible source of trouble eliminated before it was placed on the market by Hubbard & Company, Pittsburgh, Pa.

The Universal arrester is so named because it is made in only one style and may be used for line or station service on direct-current or alternating-current, constant-current or constant-potential lines of from 500 to 13,200 volts. It is claimed to be the only arrester made for distribution lines which combines four fundamental features: a choke coil to insure the removal from the line of dangerous foreign charges; a horn gap which will allow this discharge but will cut off the flow of the line current which follows it; a troubleproof construction that eliminates all repairs, cleaning and accidents and greatly reduces inspection costs; a design that allows it to be used on any central-station circuit up to 13,200 volts.

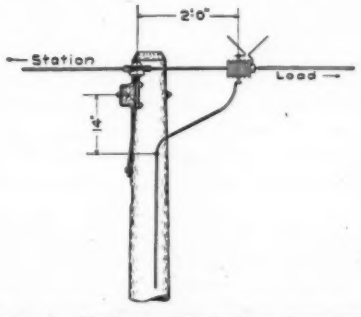


Fig. 3.—Method of Installing Arrester.

The accompanying illustrations show its construction. It is of the horn-gap, choke-coil type, and is mounted directly on the line wire, as illustrated by Fig. 3. The line wire passes through the choke coil, which is a four-inch length of iron pipe clamped inside the porcelain insulating tube. This pipe has sufficient inductance to insure the discharge of the high-frequency static charges, but does not appreciably affect the line voltage. The arrester is clamped to the line wire by the split sleeve and two set screws, shown in Fig. 1, which provide a good electrical connection for the line horn. The grounded horn is held by a set screw in the upper end of one of the clamping bands, and at this point the length of the air gap is adjusted by means of a gauge furnished with each arrester to suit the line voltage. The ground connection is inserted in the hole shown in the lower end of the other band and is held by a set screw. The brown porcelain insulator is of the Locke Insulator Company's manufacture and has a large factor of safety when used on lines of the highest voltage specified. Freedom from corrosion is insured by making the horns, bands, screws and clamp casting of brass, and by thoroughly hot-dip-galvanizing the choke coil.

Fig. 3 shows the method of installing the arrester. The horn gap is adjusted with the gauge, the line wire is cut, slipped through the arrester and spliced, and the ground connection attached to the lower end of the clamp band. It will be noted that the arrester requires no cross-arm space and may be supported far enough away from the pole to eliminate danger to linemen and the possibility of burning during severe discharges.

One of the gretest advantages of the Universal over the older types of lightning arresters for distribution lines is that it is the only one that possesses a choke coil and on this account it is the only arrester that limits the lightning discharge to the section of line in which it occurs. With the older types of arresters it is very common for every arrester on the line and in the station to discharge when the line is hit, which clearly shows the necessity for some limiting device. That the Universal is capable of carrying off the heaviest charges and breaking the power arc which follows has been demonstrated by its three years of service, without a single case of trouble due to the arresters.

Gold Medal for Standard Underground Cable Exhibit.

The Standard Underground Cable Company, Pittsburgh, Pa., has been awarded a gold medal, or highest award in its class, by the International Jury of Award, Panama-Pacific International Exposition, for its exhibit of a complete line of electric wires, cables and cable accessories.

This is the seventh award of this degree which has been received by this company in as many different expositions, and as its products have never been in similar competition oftener, this constitutes a perfect score.

The exhibit consists of samples of bare and insulated wire and cables of different kinds, illustrating the great variety of these products manufactured by the Standard Company. Cable terminals, junction boxes and other cable accessories are also shown in considerable variety adapted to various classes of service. A unique and interesting feature of this company's exhibit is the use of copper ingots as posts and a large stranded

bare copper cable as railing for inclosing its exhibit space. In order to introduce some movement into its display two braiding machines are shown in operation weaving cotton insulating braid on a copper wire.

New Mercury-Arc Rectifier for Charging Small Batteries.

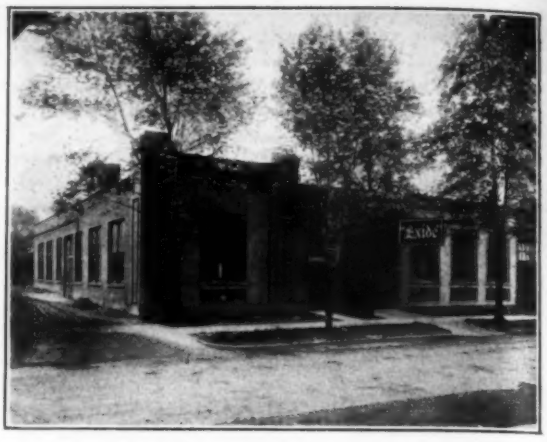
A new and inexpensive mercury arc rectifier is just being marketed by the General Electric Company for charging small storage batteries, such as are used for starting, lighting and ignition current in gasoline automobiles and motorboats, for operating electric bells, for electroplating and for numerous other uses where not over five amperes, fifteen volts direct current is required and only alternating current is available.

The new rectifier consists of a metal base, on which are mounted the necessary reactance coils and the rectifier tube in a suitable cover, the whole being encased in perforated sheet metal. It is designed for charging one three-cell, one six-cell or two three-cell batteries as required, and is automatic in that it is self-adjusting to any of these three conditions. In fact, the rectifier may be connected to a single-cell battery and will charge it at the rate of approximately six amperes from 110-volt alternating-current supply.

This type of rectifier can be furnished for 60, 50, 40, 30 or 25 cycles, 110-volt circuits. It is exceedingly compact, the outside dimensions being roughly: width, 6.5 inches; depth, 9.5 inches; height, 11 inches. The total weight of the 60-cycle rectifier is approximately 15 pounds; therefore, it may be transported from place to place in a garage, rendering unnecessary the removal of the battery from the car.

The rectifier is completely self-contained and requires no mechanical ability either to install or operate it. It is so designed that it will maintain a fairly constant current as the voltage of the battery risers. It is very easily started, simply by screwing the flexible lead attaching plug, with which it is furnished, into any convenient alternating-current lamp socket and connecting the two binding posts, distinctly marked, to the corresponding terminals of the battery to be charged. After the alternating-current supply has been turned on by the socket switch, the rectifier should be tipped slightly by means of the handle on the top. The mercury arc will then start, rectifying the current, charging the battery; the apparatus requires no further attention until the battery is entirely charged. Where two batteries are to be charged, they are connected in series and the terminals from the rectifier attached to outside posts of the two batteries.

The cost of charging either a twelve-volt battery or two six-volt batteries, for a 10-hour charge, is about 13 cents; or the same for a single six-volt battery. This cost is based on a rate of 10 cents per kilowatt-hour for current. Where the rate is less, the charging cost will be proportionately lower. This cost is exceptionally small when compared with the usual cost of at least 50 cents for charging a six-volt battery, and 75 cents for a 12-volt battery, and there is the added convenience of being able to charge on the ground. This rectifier should therefore become popular with public and private garages where only a few batteries are to be charged.



New Exide Depot, Woodward Avenue, Detroit.

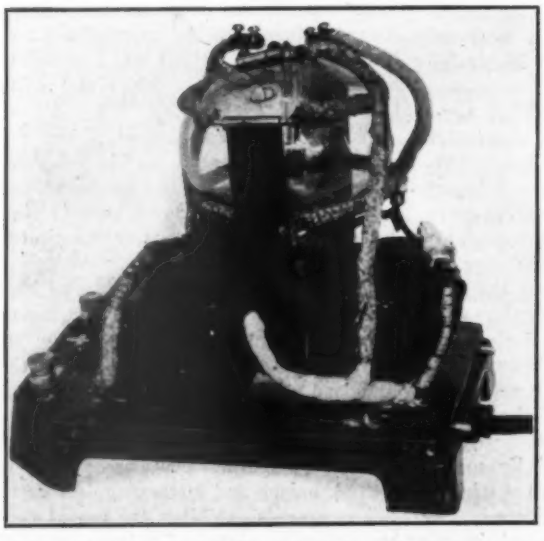
New Exide Depot in Detroit.

The Exide Battery Depots, Incorporated, of Philadelphia, Pa., has just opened a new battery depot in Detroit, Mich. This depot is located at Garfield and Woodward Avenues within easy reach of the automobile section of Detroit.

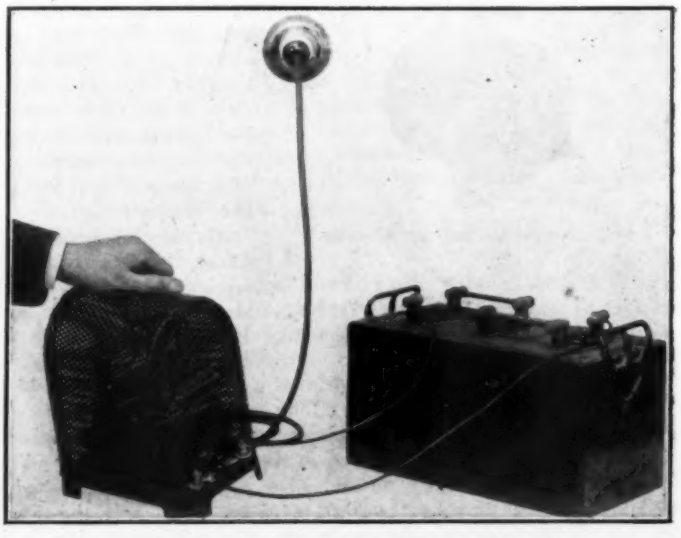
Over 5,000 square feet of floor space are available, giving ample room for all the facilities necessary in the care and repair of storage batteries. The depot is equipped with a full stock of repair parts for Exide, Hycap-Exide, Thin-Exide and Ironclad-Exide electric vehicle batteries, and also carries a full stock of complete batteries and parts for Exide starting and lighting batteries of the various types.

Application of Rotary Converters to Coal-Mining Service.

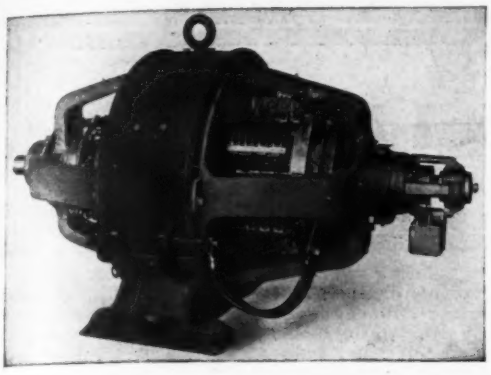
It is interesting to note the favorable impression being made by the rotary converter in coal mining, particularly since the manufacturers have developed the new commutating-pole machine in smaller sizes. One of the



Small Rectifier Charging Set, With Cover Removed.



Method of Connecting and Starting Rectifier.



Rotary Converter for Coal-Mining Service.

chief troubles in mining work, particularly with small rotaries, has been commutation because the mining load varies anywhere from 10 per cent of full load to 100 per cent overload in a very short space of time. With the non-commutating-pole rotary, it was necessary to shift the brushes with the change in load, or sparking and damage to commutator would result. This damage to commutator frequently brought about short-circuited coils and burnouts.

Since the application of commutating poles, a machine normally designed for 35 degrees rise in temperature at full load, will carry a 50 per cent overload for two hours with a rise not exceeding 55 degrees, and a momentary overload of 100 per cent without the least sign of sparking, this better performance being due to the application of the commutating poles. With this design the brushes are set on the neutral point and fixed there, and the varying loads have no effect whatsoever insofar as the sparking is concerned.

The Westinghouse Electric & Manufacturing Company has received an order from the Stonega Coke & Coal Company of Virginia for 24 rotary converters, commutating-pole type, 150 kilowatts, wound for six-phase, 60 cycles, 275 volts, direct current, operating at a speed of 1,200 revolutions per minute. These will be placed in twelve underground substations, which will be supplied with power purchased from the Kentucky Utilities Company. The power will be delivered to five points at a voltage of 33,000 and stepped down in special substations to 2,300 volts, at which voltage it will be transmitted to the mine, where there will be two banks of transformers, each consisting of three 50-kilovolt-ampere, single-phase transformers wound for 2,300 volts on the high-tension side and for the rotary voltage on the low-tension side. Each of these substations will be controlled by a five-panel switchboard.

Another installation, similar, except that it will be above ground, is the Connemaugh Smokeless Coal Company in the Pittsburgh field. This installation consists of one 200-kilowatt rotary converter, with the same characteristics as for the Stonega company. The machine is of the bracket type, as will be seen from the accompanying illustration, and the frame is of rolled steel, the feet being pressed out of a single sheet. This machine is built in three sizes, which are most popular in the mining field, i. e., 100, 150 and 200 kilowatts.

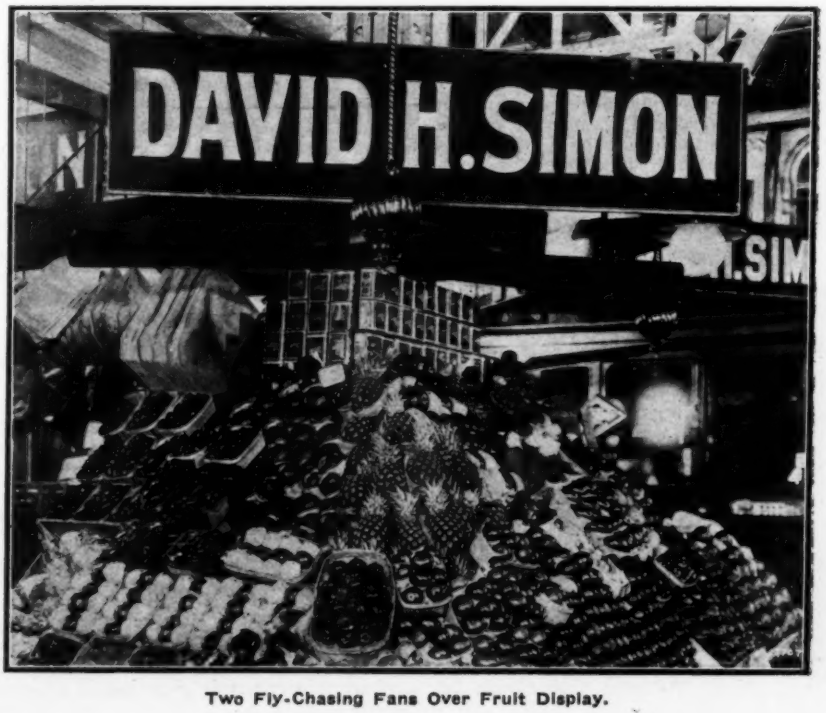
The Westinghouse company has also built this new machine in the larger sizes, having furnished one 300-kilowatt, 275-volt rotary converter of the commutating-pole type, and a machine similar in design of 500-kilowatt capacity for the Lehigh Coal & Navigation Company, at Lansford, Pa.

Fly-Chasing Electric Fan.

The anti-fly campaign now being waged in many cities has stimulated attentive study of the habits of this insect. In the psychology of the fly it has been discovered that there is an interesting trait; this is that the fly is frightened by alternate flashes of light and shadow and it is this that frequently warns it of impending doom by the "swatter." It occurred to W. C. Williams, of Philadelphia, Pa., that a modified form of electric ceiling fan could be devised to produce this alternating shadow effect over market displays of edible products and experiments showed the efficacy of this method. The fan developed for this purpose runs at 100 revolutions per minute. Its blades have only a slight pitch, so as to produce practically no breeze; their sweep is 90 inches. In the Reading Terminal Market in Philadelphia, 42 of them have been installed and they have completely solved the fly problem. The booths equipped with them are entirely free from flies, whereas in adjoining booths with the ordinary higher-speed breeze-producing shadowless ceiling fans flies are very much in evidence, in fact, seeming to enjoy the breeze. The accompanying illustration shows two of the new fans installed.

An essential feature of this method of driving away flies is to have a bright light over the fan, so that the latter produces the moving shadow on the food displayed.

These fans are known as shadow fans and are manufactured by the Robbins & Myers Company, Springfield, O.



Two Fly-Chasing Fans Over Fruit Display.

Simplex Electric Heating Company Salesmen Take High Honors.

Five of the salesmen of the Simplex Electric Heating Company, Cambridge, Mass., have been awarded prizes in the contest arranged by the Rice Leaders of the World Association, for high ability in salesmanship. Ernest R. Jackson, Chicago representative, received first prize, an Overland touring car; Ernest B. Stebbins, Philadelphia representative, the second prize, a gold watch, and Henry F. Holland, Los Angeles representative, third prize, a gold watch. The other two representatives to receive prizes were Roger P. Ingalls, of North Lexington, and Robert C. Libbey, of Jamaica Plain, Mass.

Current Electrical News

ATLANTIC STATES.

LUDLOW, MASS.—This town will install an electric lighting system, and contract for the erection of a power station.

SALEM, MASS.—The Salem Electric Lighting Company has contracted with the D. D. Sargent Company, a new firm organized for the manufacture of shoes in that city, to supply 150 to 200 horsepower to operate electric motors in this new shop.

SALEM, MASS.—Electrical energy is being used extensively in the construction of a new plant, consisting of storehouse, spinning mill and weave mill, for the Naumkeag Steam Cotton Company, at Salem. Concrete mixers and elevators are electrically operated, as are also rod-bending machines, wood saws and numerous pumps. Energy is from the Salem Electric Lighting Company.

TURNERS FALLS, MASS.—The contract for constructing the remaining half of a dam for the Turners Falls Power and Electric Company has been awarded to Fred T. Ley & Company, Springfield, Mass., who have been building a new power station at Montague City.

WENHAM, MASS.—A 150-horsepower electric motor will be installed in a pumping station now being erected in Wenham to furnish water to Salem and Beverly. Directly connected to the motor will be a pump having a capacity of 25,000,000 gallons of water a day. Energy will be furnished by the Beverly Gas and Electric Company.

DOVER, DEL.—The Mississippi Valley Railway and Power Company has been organized, with a capital of $4,500,000, to construct, maintain and operate steam and electric power motors used on all kinds of railroads, etc., to construct railways, telephone, telegraph lines, etc. Incorporators: Charles B. Bishop, Clarence J. Jacobs and Harry W. Davis, all of Wilmington, Del.

NORTH CENTRAL STATES.

CINCINNATI, O.—The Tubular Products and Steel Works, of Pittsburgh, Pa., has secured a tract of 15 acres for use as a site for a large plant in Cincinnati, where it will manufacture steel tubing for various purposes, by an electric-welding process. It is stated that the company will use 2,000 kilowatts per hour, which will be developed by its own generating plant.

LONDON, O.—An ornamental street-lighting system, involving the use of sidewalk cluster lights, is being planned by the City Council, with the support of property owners on a number of streets. L.

PAINESVILLE, O.—Bonds have been voted to enlarge the local electric light plant. Address City Clerk.

ST. MARY'S, O.—T. J. Turley, of Owensboro, Ky., has been chosen secretary and sales manager of the St. Mary's Machine Company, manufacturer of gasoline engines, which have a wide sale for small electric plants. Mr. Turley is president of the T. J. Turley Company, of Owensboro, and will continue his business and residence there. His company is sales agent for the engine for a large territory, Mr. Turley recently having acquired a considerable interest in the St. Mary's Company.

COLUMBUS, IND.—The Thomas Electric Company has been awarded the contract for the electric wiring in the new $35,000 vocational school to be built here. The general contract went to J. R. Dunlap & Company, for $26,335.

FREEPORT, ILL.—The city will probably be equipped with an improved fire alarm system. Address Mayor.

HILLSBORO, ILL.—The Southern Illinois Light and Power Company has increased its capital stock from $1,000,000 to $2,000,000.

LEWISTOWN, ILL.—Members of the City Council have entered a contract with the Lewistown Electric Light Company, increasing the street lights from 40 to 89 lights, to be run on the all-night-moonlight schedule. The installation of the 49 new lights will begin as soon as the company can secure them. Z.

HASTINGS, MICH.—The Thornapple Gas and Electric Company will increase its capital from $100,000 to $500,000.

OWOSSO, MICH.—The Owosso Improvement Association is discussing plans for new boulevard system of lighting. Address Mayor DeYoung.

LACROSSE, WIS.—Plans have been completed for erection of new power station and rehabilitation of central heating system for the Wisconsin-Minnesota Light and Power Company. Cost, $210,000. Address Mayor.

PORTAGE, WIS.—The plant of the Portage Electric Light and Power Company has been sold to Woodmansee & Davidson, of Chicago.

BUFFALO CENTER, IOWA.—A new municipal light plant will be built here. Address City Engineer.

FREDERICKSBURG, IOWA.—Bonds to the amount of $10,000 have been voted to improve the water works and electric light service. Address City Clerk.

DREXEL, MO.—An electric light plant will be built here. Bonds have been voted for the purpose. Address Mayor.

GACKLE, N. D.—Plans are being developed for the electrification of this village.

MINOT, N. D.—The Consumers' Power Company is planning to expend between $50,000 and $75,000 in the remodeling of and building an addition to its power house, and installing additional boilers, engines and other machinery for the proper carrying on of its business,

YANKTON, S. D.—Ways and means are under consideration for the installation of an electric light plant. Address John W. Summers, City Auditor.

FREMONT, NEB.—The electric light system will be extended. Address president of the Board of Local Improvements.

ELKHART, KANS.—A petition is being circulated for a special election to vote bonds for a municipal water works and light plant. Address City Clerk.

SOUTH CENTRAL STATES.

LEXINGTON, KY.—The Kentucky Utilities Company contemplates erection of two outdoor substations, for which material has been purchased. One will be of 200 kilowatts and the other 2,300 kilowatts.

LOUISVILLE, KY.—Though bids for the general contract on the new Y. W. C. A. in Louisville have been received by the architect, John Bacon Hutchings, bids on the electric wiring contract have not been called for as yet. This work will be handled through the architect's office.

LOUISVILE, KY.—The Board of Park Commissioners of Louisville is considering a project to experiment with electrically-lighted tennis courts for night play. The plan is for a trial installation in Central Park and then for extension of the service to additional courts. If the Board can find the required funds, figuring at $133 for the first court in any group, and $110 for additional adjoining courts, it is stated that courts both in Central Park and in Shelby Park, the most accessible to the largest number of people, would be fitted up for night playing.

PADUCAH, KY.—The Illinois Central Railroad has announced that it will immediately proceed to install automatic, electrically-operated blocks on the remainder of its lines in Kentucky not now so provided. This includes most of the line between Paducah and Louisville.

CHATTANOOGA, TENN.—The Board of City Commissioners is considering placing of all electric wires on Market Street between Ninth and Main Streets under ground. This section of the street is soon to be repaved and it is stated that such would be the time for construction of the conduit lines.

SHELBYVILLE, TENN.—The People's Power Company has been incorporated here with $25,000 capital, incorporators being J. E. Huffman, E. C. Huffman, A. E. McGill and others.

NEW DECATUR, ALA.—The Alabama Power Company will enlarge its lighting plant. Address T. L. Beauchamp, local manager.

BOSWELL, OKLA.—Bonds will be issued for the installation of an electric light plant. Address City Clerk.

BROWNWOOD, TEX.—The elevator and mill of the Brownwood Mill and Elevator Company here, which was recently leased by H. H. Sigman & Company, will be equipped with electric motors for operating the plant. D.

DALLAS, TEX.—It is announced that the properties of the Texas Traction Company and the Southern Traction Company will be consolidated under the law which was passed by the Legislature at its recent session. It is also stated that the interurban electric line of the Southern Traction Company, which runs from Dallas to Waco, will be extended to San Antonio, via Austin, a distance of about 185 miles. D.

DALLAS, TEX.—The Commissioners' Court of Dallas County has under consideration an application of the Texas Power and Light Company for a franchise to run its electric power transmission lines along the county roads. D.

DALLAS, TEX.—It is announced that the Dallas Union Terminal Company will install its own power plant in connection with the new Union depot, to provide heat, light and power, the cost to be $60,000. The recommendations of Chief Engineer C. H. Dana have been approved by the board of directors.

DALLAS, TEX.—The contract for the electrical work of the proposed new high school building in South Dallas has been awarded to the F. E. Newberry Electric Company, at $5,280. D.

LA PORTE, TEX.—The La Porte Water, Power and Light Company is building an extension of its lighting system to Morgan's Point through Bay Ridge. D.

WESTERN STATES.

WISDOM, MONT.—A small municipal electric-lighting plant to furnish current for illumination of city buildings and streets, costing about $5,000, is being seriously considered by the City Council. O.

SILVER CITY, N. M.—The Empire Zinc Company is installing an electric light and power plant at Cleveland.

HOLBROOK, ARIZ.—The Board of Supervisors will soon hold a hearing on the application of T. M. Quebedeaux and K. H. Myers for a franchise for the construction and operation of an electric light and power plant in this city.

ARCO, IDAHO.—Ralph Edmonds and B. Clarke, of Idaho Falls, have applied for a seven-year franchise to install and operate an electric light, power and water plant in this city, the city having the right to purchase same at the end of that period.

BOISE, IDAHO.—It is reported that McKay power dam will be replaced by the Utah Construction Company, owners of the Big Lost River Irrigation project. Estimates of cost and preliminary investigations are being made by engineers of the company. O.

COEUR D'ALENE, IDAHO.—The City Attorney has been instructed by the City Council to apply to the Public Utilities Commission at Boise for permission to construct, operate and maintain an electric light plant and waterworks system. If permission is granted, according to reports, steps will be taken immediately to install the improvements. O.

ABERDEEN, WASH.—The City Council has refused to grant George H. Tilden, of Seattle, a franchise for the operation of an electrical system.

ELLENSBURG, WASH.—The $60,000 municipal light bond issue of this city has been purchased by the State Board of Finance.

SEATTLE, WASH.—An effort to purchase a developed power site for the city of Seattle, as an auxiliary to the municipal lighting plant, is being made by Superintendent of Lighting J. D. Ross. In a recent communication to the Council, Superintendent Ross recommended that the capacity of the Lake Union steam auxiliary in Seattle be doubled, estimating this improvement to cost approximately $400,000. Mr. Ross advises that the power plant be acquired and the steam plant doubled, stating that in his opinion it will be some time before the Cedar Falls power plant at Camp No. 2 will be ready for service, because of the great amount of work necessary to seal the impounding basin. The Lake Cushman power site is favored by Superintendent Ross, who advises that same be purchased and developed by the city of Seattle. The question of doing this has been so strenuously opposed by the Council that the Lighting Department has decided that it would be more suitable to purchase a plant already developed. It is understood the Elwha plant, near Port Angeles, can be purchased for approximately $2,500,000, and the city is making investigations which may lead to the purchase of the property. The proposition of purchasing current from nearby power plants, or from mills in Seattle, operated by electricity, has been abandoned. O.

TACOMA, WASH.—A resolution of intention creating local improvement district numbered 5507, where an up-to-date street-lighting system will be installed, has been passed by the City Council. It is understood the improvement will be made this summer.

TACOMA, WASH.—A new power house, and additional electrical machinery for various parts of the plant, are among the improvements to be made at the plant of the Tacoma Smelting and Refining Company, according to W. R. Rust, president of that concern. An additional fine copper furnace will also be installed, and the copper refinery will be doubled in size. O.

PORTLAND, ORE.—Approximately $19,000 will be expended in the city of Portland in making needed extensions and improvements to the telephone system, according to Manager Fred Spoeri, of the Pacific Telephone and Telegraph Company. O.

PORTLAND, ORE.—The Power Equipment Company of this city has opened an office in Seattle, Wash., at 524 Central Building, where W. A. Rode is in charge. H. L. Shepard, president of the company, states that they now represent the Kerr Turbine Company, Alberger Pump and Condenser Company, E. Keller Company, and the Elliott Company, all power equipment concerns, and the De La Vergne Machine Company.

ANAHEIM, CAL.—The Board of Supervisors has granted the application of the Pacific Telephone and Telegraph Company to lay a pipe line in the Garden Grove and Bolsa road districts.

CORONA, CAL.—A committee has been appointed by the city trustees to investigate the proposition of a municipal electric light plant.

GILROY, CAL.—At a recent election a lighting district was established at San Martin.

LOS ANGELES, CAL.—Application has been made to the Board of Supervisors for the transfer of a contract for a lighting system in the Miramento and Florence Lighting District, from the Los Angeles Gas and Electric Company to the Pacific Light and Power Corporation.

LOS ANGELES, CAL.—The City Council has resolved that the City of Los Angeles issue, sell and deliver to the sinking fund in the treasury of the city, known as the "Electric Plant Bond Election 1910 Interest and Sinking Fund," $117,000 of bonds, being part of the issue of $6,500,000 electric plant bonds authorized by voters at a special election. The bonds are part of an issue of $1,432,000 Class A bonds described in an ordinance adopted June 19, 1914, numbered and payable as follows: Bonds No. 113 to 156, inclusive, on August 1, 1920; bonds 157 to 195, August 1, 1921; Bonds No. 196 to 234, August 1, 1922.

LOYALTON, CAL.—July 12 has been set as the date for a special election for voting on a $5,000 bond issue for the construction of an electric light and power plant.

MONROVIA, CAL.—J. H. Bartle, president of the First National Bank of this city, has purchased from L. C. Brand, of Casa Verdugo, the San Fernando Valley Home Telephone Company. It is understood the new management will make many improvements in the service.

PLACERVILLE, CAL.—The Western States Gas and Electric Company is preparing to increase the capacity of the American River flume, to renew the bulkhead on the south side of the American River dam and to install an additional 1,500-kilowatt generator at the power house, located about five miles north of this city. The improvements will be commenced by November, this year.

REDONDO, CAL.—Requests have been submitted to the City Council by the Pacific Light and Power Corporation and the Pacific Electric and Associated Oil Company to install pipe lines on Railway Avenue and to extend their lines to Wharf No. 2.

RIVERSIDE, CAL.—The City Council has passed a resolution ordering the improvement of East Fifth, Sixth, Seventh, Eighth and Ninth Streets, Pachappa, Park, High, Sodgwick, Comer, Eucalyptus, Franklin and Kansas Avenues by the installation of electric lights.

SACRAMENTO, CAL.—The Pacific Gas and Electric Company will expend $10,000 for improvements.

WILLIAMS, CAL.—The city trustees have passed a resolution calling for bids for the installation of a street-lighting system.

PROPOSALS.

LIGHTING FIXTURES.—Sealed bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until August 13, for the lighting fixtures for the new United States post office at Gardiner, Me. Drawings and specifications may be obtained from the custodian of site at Gardiner, Me., or at the office of the Acting Supervising Architect, Washington, D. C.

LIGHTING FIXTURES.—Sealed proposals will be received until August 11, at the Supervising Architect's Office, Treasury Department, Washington, D. C., for lighting fixtures to be installed at the United States post office at Wellsburg, W. Va. Drawings and specifications may be obtained from custodian of site at Wellsburg, W. Va., or from James A. Wetmore, Acting Supervising Architect, Washington, D. C.

WARREN, MINN.—G. O. Gross, city recorder, will receive bids until July 22, for labor and materials in constructing an addition and making improvements to the municipal electric light plant. Work will consist in furnishing and erecting one brick addition to present building, piping connections, etc., one 150-kilowatt, direct-current engine-generator unit, switchboards, etc. Alternate bids are also invited on alternating-current apparatus of equivalent rating.

ELECTRIC GENERATOR.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until July 30, for supplying to the experimental station, United States Bureau of Mines, Pittsburgh, Pa., one electric generator and generator panel, in accordance with specification, copies of which may be obtained at the office of James A. Wetmore, Acting Supervising Architect, Washington, D. C.

MILACA, MINN.—Proposals will be received by W. A. Erickson, recorder, until July 20, for alterations and additions to the city's power-plant equipment. Present boilers and auxiliary equipment are to be dismantled and removed, and new and larger boilers and certain new auxiliary equipment to be installed. Plans at office of recorder, Minneapolis and St. Paul Builders' Exchanges, and in the office of C. L. Pillsbury Company, engineers, Minneapolis.

LAKEFIELD, MINN.—E. C. Andersen, village recorder, will receive bids until July 28, on the construction of additions and improvements to the waterworks and electric light plant as follows: For waterworks: one motor-driven deep well pump; one motor-driven centrifugal pump. For electric plant: one 125-horsepower fire tube boiler breeching, 4x100 feet; concrete chimney, piping connections, etc.; one 75-kilovolt-ampere belted alternator for present engine; one 100-kilovolt-ampere engine-generator unit, switchboard, etc. (Alternate) one 160-horsepower Diesel oil engine, direct connected to one 100-kilovolt-ampere alternator, including all auxiliaries; one 75-kilovolt-ampere belted alternator for present engine, switchboard, etc.; poles, wire, street lamps, transformers, etc. Erle D. Jackson, St. Paul, Minn., is consulting engineer for the village and has the specifications for the new equipment available.

FOREIGN TRADE OPPORTUNITIES.

[Addresses may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch offices at Boston, New York, Atlanta, Chicago, St. Louis, New Orleans, Seattle and San Francisco. Write on separate sheet for each item and give file number.]

TELEPHONE EQUIPMENT, NO. 17,326.—A firm in Paris advises an American consular officer that it desires to communicate with American manufacturers of telephones and telephone equipment. Samples of wire, catalogs, and prices should be sent immediately. Correspondence may be in English.

ELECTRIC MOTORS, ETC., NO. 17,357.—An American consular officer in France reports that a number of civil engineers in his district desire to communicate with American manufacturers and exporters of electric motors and all accessories of electric installations. Quotations should be c. i. f. French ports. Payment will be made against shipping documents in France.

ELECTRICAL FITTINGS, NO. 17,395.—An American consular officer in England reports that a firm in his district desires to receive quotations from American manufacturers of lamp-holders (sockets) fitted with cord grip and shade-holder—bayonet type, and one-half inch and five-eighths inch plain and with shade-holder, and with key; ceiling roses, two-plate and three-plate; enameled-iron shades, 8, 9, 10, 12, 15 and 18 inches; porcelain cleats; porcelain fuses, 5 and 10 amperes; tumbler-pattern switches, 5 and 10 amperes—all suitable for 250 volts. Prices should be quoted c. i. f. British ports.

CARBONS AND ELECTRIC LAMPS, NO. 17,412.—An American consular officer in Italy transmits a detailed report relative to an opportunity for the sale of carbons and electric lamps. A copy of the report may be had on application and samples of the carbons may be examined at the Bureau of Foreign and Domestic Commerce or its branch offices.

ELECTRICAL ACCESSORIES, CHEMICALS, ETC., NO. 17,418.—The Bureau of Foreign and Domestic Commerce is in receipt of a letter from a business man in India, stating that he desires to communicate with American manufacturers and exporters of electrical accessories, chemicals, etc., to be used in dyeing and coloring. He is also interested in hardware, machinery, and railway supplies. He states that he will arrange to pay cash in New York. He states that he is also in need of a reliable buying agent to represent him in the United States.

NEW INCORPORATIONS.

WILMINGTON, DEL.—The McHugh Electric Company has been organized with a capital of $25,000.

MIDDLETOWN, O.—The Butler Cycle and Electric Company has been chartered, with a capital of $10,000, by H. D. Riley and others.

NEW HAMPTON, MO.—New Hampton Electric Company. Capital, $4,000. Incorporators: C. A. Rowland, W. A. Denny and E. C. Morgan.

NEW HOLLAND, ILL.—New Holland Light and Power Company. Capital, $4,000. Incorporators: Harry Cooper, G. A. Trenkle and James Ryan.

BELFIELD, N. D.—The Chryster Light & Power Company has been incorporated with a capital of $25,000 by George S. Chryster, Beach, N. D., and others.

MARTINSVILLE, IND.—Morgan County Light and Power Company. Capital, $45,000; electric light. Directors J. H. Stewart, J. J. Albion L. Lowenberg.

NEW YORK, N. Y.—The Power Generating Company has been incorporated, with a capital of $10,000, by Frederick Krause, W. H. Kimmell and C. A. Broder.

AKRON, O.—The Wolfsperger Electrical Company has been organized by W. E. Wolfsperger, Frank M. Peck, William H. Mallery, J. V. Kahl and S. E. Klein, with a capital stock of $5,000.

ATHENS, O.—The Central Electric Producing Company has been organized with a capital of $300,000, by H. D. Mannington, O. E. Harrison, H. C. Allread, E. H. Davis and H. R. Schweinsberger.

BROOKLYN, N. Y.—Charles T. Staines, Incorporated; to manufacture electric and gas lighting fixtures. Capital, $5,000. Incorporators: Charles T. Staines, Abraham Levitt and Olga Koski.

CLEVELAND, O.—The Kenohio Electric Company has been incorporated, with a capital stock of $10,000, by William J. Kenyon, Floyd E. Waite, L. M. Sewell, E. G. Hoag and Charles A. Colvin.

ROCHESTER, N. Y. — Rochester Electrical Supply Company, Incorporated. Capital, $25,000. Incorporators: Bernard E. Finucane, Clarence M. Platt and Carl F. W. Kaelber, all of Rochester.

NEW BRITAIN, CONN.—The Spring & Buckley Electric Company, of New Britain, has been organized, with a capital of $25,000, by G. K. Spring, of Newington, John H. Buckley, of New Britain, and others.

BOSTON, MASS.—The L. L. Bates Company has been incorporated, for the purpose of installing burglar and fire-alarm systems; capital stock, $10,000. Incorporators, Oscar W. Codding, William E. Nutting, George E. Bradford.

BOSTON, MASS.—The Case Company has been incorporated, to manufacture and deal in electric and other motor vehicles. Capital stock, $30,000. Incorporators, Frank K. Bull, Charles A. Snow, Nettie M. Bates. W.

CANANDAIGUA, N. Y.—W. R. Townley & Company, Incorporated; to manufacture wire cable, lightning conductors, etc. Capital, $5,000. Incorporators: William R. Townley, Milton Rapalyo and Patrick H. Menihan.

BOSTON, MASS.—The Universal Light Company has been incorporated with a capital of $10,000, to deal in and install electric and other lighting fixtures. Incorporators, Frank A. Epstein, Harry E. Epstein, Paul E. Epstein.

NEW HOLLAND, ILL.—The Holland Light and Power Company has been incorporated, with a capital of $4,000, by Harry Cooper, G. A. Trenkle and others, to supply light and power in the town and along the line to Mason City.

RINARD, ILL.—The Rinard Electric Company has been incorporated with a capital stock of $2,000. The company is to furnish current for lights and other purposes. The incorporators are A. R. Smith, F. M. Smith and A. J. Phillips. Z.

CLINTON, TENN.—The Clinton Electric Light and Power Company has been granted a charter by the secretary of state. It has a capital stock of $10,000. The incorporators are H. G. Amerine, J. H. Underwood, C. J. Sawyer, E. E. Cross and O. S. Scruggs.

TRENTON, N. J.—Articles of incorporation have been filed by the Standard Electric Company. Those interested are Henry M. Hartman, Walter D. Cougle and Charles E. Milum. The company is capitalized at $125,000, and will deal in electrical, steam, gasoline and other kinds of goods.

ST. CLOUD, MINN.—The St. Cloud Public Service Company, with a capital of $2,000,000 has filed articles of incorporation with the secretary of state. A. G. Whitney, R. L. Gale, A. D. McKenzie, P. H. Collingnon and W. H. Stewart, all of St. Cloud, are the incorporators.

BOSTON, MASS.—The New England Fuse Manufacturing Company has been incorporated with a capital of $1,500, to buy, sell and manufacture mechanical supplies. The incorporators are Frank Sanford, Whitman, Mass.; Arthur W. Brooks, Natick; William F. Poole, Cambridge.

PORTLAND, ME.—A certificate of organization has been filed by the Chantray Manufacturing Company to manufacture and deal in all kinds of lighting devices. Capital stock, $100,000. The officers of the company are Horace E. Eaton, president; Benjamin G. Ward, clerk; Harold S. Richards, treasurer.

LYNN, MASS.—The Reliance Electric Company has been incorporated with a capital stock of $5,000. The incorporators are: President, Fred R. Farwell; treasurer, W. W. Moore; directors, Wilbur B. Flanders and Clark W. Shattuck. The purposes of incorporation are, to carry on the business of electrical contractors and manufacturers of apparatus.

BOSTON, MASS.—The Flagg Marine Signal Company has been incorporated with a capital stock of $10,000, for the purpose of manufacturing and dealing in marine and land signals and other electrical appliances. The incorporators are: President, Isaac V. Brock, Boston; treasurer, Amasa C. Gould, Newton; directors, E. C. Fisher, W. J. Martin, G. R. Merrill.

FINANCIAL NOTES.

Stockholders of the Southern New England Telephone Company, in a special meeting, voted to accept an amendment to the charter giving the company the right to increase its authorized stock from $10,000,000 to $20,000,000. No new issue is contemplated at the moment.

Connecticut Power Company has sold to Stone & Webster $300,000 first and consolidated five-per-cent bonds which are being offered at 95 and interest or on a 5.30 basis. The proceeds from the sale of these bonds will be applied toward the refirement of the floating indebtedness of the company amounting to $405,000 incurred for extensions and improvements made to meet the demands of increasing business.

The property of the Dorchester Electric Company has been sold in foreclosure proceedings to the committee of stockholders for $100,000. Recently interests associated with the Shawinigan Water & Power Company organized a new corporation with $3,000,000 capital, and it is reported that this company will take over Dorchester Electric when the reorganization is completed and will operate it in close relationship with the Shawinigan company.

Dividends.

	Term.	Rate.	Payable.
Asso. Gas & Elec.	Q	1.5 %	July 15
Bay State St. Ry. pf.	S	$3.00	Aug. 2
Boston Sub. Elec.	Q	50c	July 15
Commonwealth Edison	Q	2 %	Aug. 2
Dayton Pr. & Lt. pf.	Q	1.5 %	July 15
Detroit United	Q	1.5 %	Sept. 1
Duquesne Lt. pf.	Q	1.75%	Aug. 2
Elec. Util. Corp. pf.	Q	1.25%	July 15
International Trac. pf.	S	2 %	July 15
North. Ontario Lt. & Pr. pf.	S	3 %	July 15
North. States Pr. pf.	Q	1.75%	July 15
Ottumwa Ry. & Lt. pf.	Q	1.75%	July 13
Penn. Cent. Lt. & Pr. pf.	Q	1 %	July 5
Pub. Serv. Inv. pf.	Q	$1.50	Aug. 2
Pub. Serv. of No. Ill. pf.	Q	1.5 %	Aug. 1
Pub. Serv. of No. Ill. com.	Q	1.25%	Aug. 1
Puget Sd. Tr., Lt. & Pr. pf.	Q	75c	July 15
Ry. & Lt. Sec. pf.	S	3 %	Aug. 2
Ry. & Lt. Sec. com.	S	3 %	Aug. 2
United Rys. & Elec. com.	Q	50c	July 15
West. Sts. Gas & Elec.	Q	1.75%	July 15

Reports of Earnings.

REPUBLIC RAILWAY & LIGHT.

	1915	1914
April gross	$237,745	$252,461
Net after taxes	88,077	100,286
Surplus after charges	31,269	44,291
Balance after preferred dividends	5,312	18,334
Four months' gross	962,584	991,579
Net after taxes	356,335	373,610
Surplus after charges	128,894	150,877
Balance after preferred dividends	25,066	47,049

DETROIT EDISON COMPANY.

	1915	1914
May gross	$ 577,727	$ 485,927
Net after taxes	207,110	164,689
Surplus after charges	119,228	95,760
Five months' gross	3,189,170	2,701,337
Net after taxes	1,230,334	973,100
Surplus after charges	810,734	632,128

CITIES SERVICE COMPANY.

	1915	1914
April gross	$ 342,337	$ 337,223
Net after expenses	327,039	328,260
Balance after interest	286,206	299,093
Surplus after preferred dividends	155,373	162,261
Twelve months' gross	3,946,539	3,076,961
Net after expenses	3,808,932	2,983,099
Balance after interest	3,342,265	2,743,370
Surplus after preferred dividends	1,730,270	1,541,128
Balance after common dividends	1,573,236	894,799

PACIFIC LIGHT & POWER.

	1915	1914
May gross	$ 227,156	$ 210,865
Net after taxes	152,324	131,385
Total income	163,352	142,307
Surplus after charges	54,737	23,650
Five months' gross	1,136,916	1,053,882
Net after taxes	744,306	605,754
Total income	799,976	679,456
Surplus after charges	259,273	176,656

UTAH SECURITIES CORPORATION.

	1915	1914
May gross	$ 378,314	$ 373,128
Net after taxes	188,912	182,098
Five months' gross	1,876,977	1,876,708
Net after taxes	955,587	931,027

COMMONWEALTH POWER, RAILWAY & LIGHT.

	1915	Changes from 1914
May gross	$1,108,008	Inc. 0.16%
Net earnings	586,396	Inc. 0.18%
Surplus after charges	162,293	Dec. 8.24%
Balance after preferred dividends	82,293	Dec. 15.04%
Five months' gross	5,722,698	Dec. 0.67%
Net earnings	3,017,797	Inc. 1.59%
Surplus after charges	886,110	Dec. 4.37%
Balance after preferred dividends	486,110	Dec. 7.63%
Twelve months' gross	14,017,929	Inc. 0.97%
Net earnings	7,291,945	Inc. 6.33%
Surplus after charges	2,203,286	Dec. 0.19%
Balance after preferred dividends	1,243,286	Dec. 0.33%

WESTERN POWER COMPANY.

Western Power Company reports for the fiscal year ended December 31, 1914, as follows:

	1914	1913
Gross earnings	$2,681,099	$2,698,214
Expenses and taxes	873,763	965,970
Net earnings	1,807,335	1,732,245
Other income	246,235	231,854
Total income	2,053,571	1,964,099
Interest charges	1,280,849	1,183,751
Surplus	772,721	780,358
Dividends on California Electric Generating preferred	150,000	150,000
Sinking funds	53,275	53,585
Other deductions	227,070	24,276
Additions to surplus	7,223	46,075
Unappropriated balance of surplus	349,610	598,562

NORTHERN OHIO TRACTION & LIGHT.

	1915	1914
May gross	$ 323,374	$ 323,036
Net after taxes	132,007	131,228
Surplus after charges	80,483	80,568
Balance after preferred dividends	64,160	65,733
Five months' gross	1,424,675	1,403,920
Net after taxes	523,907	543,810
Surplus after charges	267,946	292,995
Balance after preferred dividends	185,333	217,969

NORTHERN STATES POWER.

	1915	1914
May gross	$ 374,830	$ 333,878
Net after taxes	202,713	172,078
Twelve months' gross	4,716,528	4,208,890
Net after taxes	2,604,593	2,191,115

Operating results twelve months ended May 31, 1915:

Gross earnings	$4,688,438
Expenses, taxes and maintenance	2,103,574
Net earnings	2,584,864
Interest and other charges	1,461,027
Surplus	1,123,837
Preferred dividends	587,069
Balance available for depreciation and common dividends	536,768

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	July 5.	June 28.
American Tel. & Tel. (New York)	120½	123⅜
Commonwealth Edison (Chicago)	135	134
Edison Electric Illuminating (Boston)	237	237
Electric Storage Battery common (Philadelphia)	53¼	52½
Electric Storage Battery preferred (Philadelphia)	53¼	52½
General Electric (New York)	168½	171
Kings County Electric (New York)	119	119
Massachusetts Electric common (Boston)	5½	5¾
Massachusetts Electric preferred (Boston)	35½	36
National Carbon common (Chicago)	137	140
National Carbon preferred (Chicago)	120	117
New England Telephone (Boston)	129	129
Philadelphia Electric (Philadelphia)	23¾	23½
Postal Telegraph and Cables common (New York)	75	79
Postal Telegraph and Cables preferred (New York)	66¼	64
Western Union (New York)	66⅛	66⅛
Westinghouse common (New York)	99¾	100
Westinghouse preferred (New York)	123¼	125

NEW PUBLICATION.

ELECTRICAL MEASURING INSTRUMENTS.—A second edition of Circular No. 20. recently issued by the Bureau of Standards, Washington, D. C., has been completely revised. It describes the operating principles of electrical instruments used for commercial measurements, including ammeters, voltmeters and wattmeters. It gives such information on the errors of instruments as will assist those who use them to obtain the most accurate results in any given case. Other related subjects are treated as follows: Current and voltage transformers, which make it possible to measure currents so large and voltages so high as to be out of the range of ordinary instruments; standard apparatus by which ordinary instruments may be checked.

PERSONAL MENTION.

MR. GEORGE F. STOLDT has been appointed superintendent of the Jacksonville, Ill., municipal electric light plant, succeeding Mr. W. H. Catherwood.

HON. ALONZO R. WEED has been reappointed a member of the Massachusetts Gas and Electric Light Commission by Governor Walsh. Mr. Weed has been chairman since the death of Mr. Forrest E. Barker, November 20, 1914.

MR. FRANK R. FARNHAM has joined the staff of Walter B. Snow, publicity engineer and advertising agent, Boston, Mass. Mr. Farnham was previously with the McGraw Publishing Company, New York, in charge of the copy service department for its several publications.

MR. J. WILLIAM ELLIS, who is said to be the only blind wireless operator in the world, has opened a station at Rocky Point, R. I., for exhibition and transmission purposes. He will communicate with ships at sea, and give demonstrations of the working of the radio apparatus to visitors. Mr. Ellis has been a wireless operator for the past 10 years, and has also manufactured and installed outfits.

PROF. CHARLES M. SPOFFORD, of the firm of Fay, Spofford & Thorndike, consulting engineers, Boston, and head of the Department of Civil and Sanitary Engineering of the Massachusetts Institute of Technology, has been appointed by the Governor of Massachusetts a member of the Terminal Commission, constituted by a recent legislative act to investigate the subject of terminal facilities and the improvement of facilities for the transportation of freight in the Boston Metropolitan District.

MR. MIKE S. HART, one of the most popular electrical men of Chicago and vicinity, has resigned as general manager of the commercial department of the Middle West Utilities Company, to go into the cotton brokerage business in New Orleans, La., with headquarters at 506 Hibernian Bank Building. Mr. Hart has been connected with the electrical industry for many years, and superintended the construction work of the Consumers Electric Company, of New Orleans, in the employment of his father. Later he was made secretary and superintendent of the company. The property subsequently passed through a receivership and became known as the Consumers Electric Light and Power Company, the receiver, Mr. Samuel Insull, appointing Mr. Hart as general manager. When the commercial department of the Middle West Utilities Company was organized in 1912, Mr. Hart was appointed general manager. In this important position he carried out many aggressive sales campaigns, and was responsible for the excursion of a fully-equipped electrical exposition car to all of the company's properties. In addition to his business activities, Mr. Hart has been conspicuous in fraternity work, and his services as a Jovian have been marked and productive of considerable development on behalf of the Order. He has been a Statesman of the Jovian Order for both Louisiana and Illinois, and was secretary of the Rate Research Committee of the National Electric Light Association for two years. In Chicago, Mr. Hart took a prominent part in the councils of the local Jovian League, acting on various committees and serving as one of the managers since its inauguration.

DATES AHEAD.

Ohio Electric Light Association. Annual convention, Cedar Point, O., July 20-23. Secretary, D. L. Gaskill, Greenville, O.

National Electrical Contractors' Association of the United States. Fifteenth annual convention, San Francisco, Cal., July 21-24. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y.

American Association for the Advancement of Science. Summer meetings, San Francisco, Cal., August 2-7, Secretary, L. O. Howard, Washington, D. C.

International Association of Municipal Electricians. Annual meeting, Gibson Hotel, Cincinnati, O., August 24-27. Secretary, C. R. George, Houston, Tex.

Indiana Electric Light Association. Annual convention, Hotel Deming, Terre Haute, Ind., September 8-10. Secretary, T. Donahue, La Fayette, Ind.

Pennsylvania Electric Association. Annual convention, Bedford Springs, Pa., September 8-10. Secretary, H. N. Mueller, 435 Sixth Avenue, Pittsburgh, Pa.

Association of Iron and Steel Electrical Engineers. Annual convention, Hotel Statler, Detroit, Mich., September 8-11. Secretary, W. T. Snyder, McKeesport, Pa.

Northwest Section, National Electric Light Association. Annual convention, Portland, Ore., September 8-11. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash.

New England Section, National Electric Light Association. Annual convention, Mt. Kineo House, Kineo, Me., September 14-17. Secretary, O. A. Bursiel, 149 Tremont Street, Boston, Mass.

American Electrochemical Society. Twenty-eighth general meeting, San Francisco, Cal., September 16-18. Secretary, Joseph W. Richards, South Bethlehem, Pa.

Illuminating Engineering Society. Annual convention, New Willard Hotel, Washington, D. C., September 20-23. Assistant secretary, Joseph Langan, 29 West Thirty-ninth Street, New York, N. Y.

International Engineering Congress, San Francisco, Cal., September 20-25. Executive secretary, E. J. Dupuy, Foxcroft Building, San Francisco, Cal.

Telephone Pioneers of America, Annual meeting, San Francisco, Cal., September 21-23. Secretary, R. H. Starrett, 15 Dey Street, New York, N. Y.

Southeastern Section, National Electric Light Association. Annual convention, Grove Park Inn, Asheville, N. C., September 22-24. Secretary, George H. Wygant, Tampa, Fla.

Colorado Electric Light, Power and Railway Association. Thirteenth annual convention, Glenwood Springs, Colo., September 23, 24 and 25. Secretary, Thomas F. Kennedy, 900 Fifteenth Street, Denver, Colo.

Electric Vehicle Association of America. Annual convention, Cleveland, O., October 18-20. Executive secretary, A. J. Marshall, 29 West Thirty-ninth Street, New York City.

With the Electrical Manufacturers

The Electric Controller and Manufacturing Company, Cleveland, O., has appointed the O. H. Davidson Equipment Company, 510 Ideal Building, Denver, Colo., and the O. H. Davidson Equipment Company, Walker Bank Building, Salt Lake City, Utah, as its selling agents.

Delta-Star Electric Company, Chicacago, Ill., is distributing descriptive leaflet No. 740, describing the construction of high-tension outdoor wooden-pole substations. Ten typical installations are shown, which will be of interest to those concerned in high-tension transmission.

The Metalyte Company, Incorporated, 366 West Fifteenth Street, New York City, manufacturer of incandescent lamps, has opened a Chicago office at Room 412, 105 West Monroe Street. This is in charge of J. L. Brantigan, who was formerly in the Winnipeg, Canada, office of the company.

Railway & Industrial Engineering Company, Greensburg, Pa., has issued a booklet of views and brief descriptions of Burke horn-gap switching and protective equipment for outdoor substations. A considerable number of such substations of various voltages and sizes are also shown. The company is prepared to design and furnish equipment for practically any outdoor-substation requirements.

The Fargo Manufacturing Company, Incorporated, Poughkeepsie, N. Y., manufacturer of electrical wiring and mechanical devices, has ready for distribution catalog No. 700, devoted to mechanical connecting devices; catalog

No. 402, devoted to wiring devices, and catalog No. 800, devoted to electrical and mechanical devices, including cable lugs, cable grips and connectors. These catalogs will be sent to those interested upon request.

The Electrical Sales Engineers, Incorporated, 19 South Fifth Avenue, Chicago, will hereafter, by arrangement with the Thomas G. Grier Company, of Chicago, represent exclusively the Condit Electrical Manufacturing Company, of Boston, Mass., and the Luminous Unit Company, of St. Louis, Mo. The following are the officers of the company: Paul W. Koch, president and general manager, formerly manager of the Thomas G. Grier Company; Fred B. Duncan, vice-president, formerly sales engineer of the George Cutter Company; Alfred O. Dicker, secretary and treasurer, formerly illuminating engineer, Commonwealth Edison Company.

The Harvey Company, 113 South Street, Baltimore, Md., has been organized under the laws of the State of Maryland to establish a supplies and equipment department for railroads, contractors, industrial and isolated plants, garages, etc. Arrangements will be made for quick shipments either direct from mill or stock at warehouse in Baltimore. A storage yard will be maintained at Curtis Bay, Md., on the Baltimore & Ohio Railroad. J. Edward Harvey, president of the company, is well known to the railway and contracting fields, and was formerly vice-president of the South Baltimore Steel Car and Foundry Company, of Baltimore, and was also proprietor of the Eastern Railway Supply Company. The company desires complete catalogs from manufacturers.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently issued a number of new publications, among which are the following: "Considerations in the Design of Railway Motors," a treatise on the ventilation of this type of motor, by R. E. Hellmund, has been issued in pamphlet form; this is a reprint of an interesting article which appeared in the *Electric Journal*. The June issue of Westinghouse Railway Data Exchange is on the subject of freight haulage; it contains several articles, among which are: "Fast-Freight Service on the Winona Interurban Railway," "Effect of Brake-Setting on Power Consumption," and "Effect of Car-Wheel Diameter on Motor Heating," all containing valuable information on freight haulage by electric locomotives. Leaflet No. 3823 describes the construction and operation of rotary converters of the commutating type; a number of construction details are illustrated and several installation views are shown. Leaflet No. 3760 describes alternating-current, remote hand-control switchboards; it describes the application of this type of board, together with the different methods of mounting, and gives a typical wiring diagram. Leaflet No. 3820 describes alternating-current heavy-duty slip-ring motors, which are especially adapted for constant and varying-speed applications where continuous service and strong starting effort are required, and where squirrel-cage motors would not be adaptable. Leaflet No. 3787 is devoted to large-squirrel-cage induction motors. Folder 4197-N describes the various types of Westinghouse electric household helps. Leaflets 3789 and 3790 are descriptive of Type C semi-magnet and full-magnet elevator control, both of which are suitable for freight and passenger elevators. The paper read by W. M. Dann and H. H. Rudd before the Ohio Society of Mechanical, Electrical and Steam Engineers, at Toledo, O., on June 17, with the title "The Use of Current-Limiting Reactors," has been reprinted in pamphlet form. Telephone battery charging by means of the mercury rectifier has been described in folder No. 4204-A. Small Motors No. 23 describes and illustrates the type CA single-phase motor and its starting mechanism; this motor is made in sizes from one-twentieth to three-quarter horsepower. Descriptive leaflet No. 2322-C covers the complete line of type AR single-phase motors, and descriptive leaflet No. 2362-C illustrates and describes the line of type CA single-phase small motors for use in the home, office and shop. The July issue of the Show Window Calendar, a monthly publication issued by the company to assist distributors of its electric ware, contains suggestions especially suitable for July Fourth. Catalog Section DS930 describes electrostatic ground detectors and voltmeters: these are for use on both single-phase and polyphase circuits and are connected to the circuit through condensers; they are both sensitive and economical.

Record of Electrical Patents

Issued by the United States Patent Office, June 15, 1915.

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,142,791. Electrical Equipment for Internal-Combustion Engines. V. G. Apple, assignor to Apple Electric Co., Dayton, O. Wiring and switches in dynamo and battery equipment for starting and lighting.

1,142,804. Telephone-Receiver Support. A. H. Drake, Waterloo, Iowa. Extensible bracket secured to telephone normally depresses hook but releases same when extended to hold receiver to ear.

1,142,818. Cap for Lamp Shells, Switch Receptacles, and Analogous Devices. C. J. Klein, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Insulating lining secured by interlocking with metal cap.

1,142,819. Cap for Lamp Sockets and the Like. C. J. Klein, assignor to Cutler-Hammer Mfg. Co. Has metallic lining with enameled insulating surface.

1,142,833. Electric Welding. J. A. Muir, assignor to the Toledo Electric Welder Co., Cincinnati, O. Welding current controlled automatically or at will.

1,142,835. Outlet Box for Protective Casings for Line Conductors. T. E. Murray, New York, N. Y. Structural details of sheet-metal box. (See cut.)

1,142,846. Trolley-Wheel Mount. T. Sanders, Kingman, Ind. Details of wheel contactor.

1,142,847. Circuit-Controlling Mechanism. E. Schildhauer, Culebra, Canal Zone. Electromagnetically operated means for locking oil switch closed controlled by handle.

1,142,852. Electromagnet and Solenoid. A. Simon, assignor to Cutler-Hammer Mfg. Co. Auxiliary plunger cuts down current after main plunger operates.

1,142,857. Automatic Telephone Signaling System. M. Suwa, Tokyo, Japan. Rings by unbalancing of transmitter batteries when receiver is taken down.

1,142,858. Electroresponsive Regulator. L. L. Tatum, assignor to Cutler-Hammer Mfg. Co. Operation accelerated but overrunning prevented.

1,142,859. Electric Switch. A. A. Tirrill, Schenectady, N. Y. Pull-cord rotary snap switch.

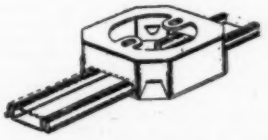
1,142,861 and 1,142,862. Electrical Heating Unit. E. G. Van Wie and R. W. Davenport, assignors to Detroit Stove Works, Detroit, Mich. Mounting of electrically heated plate and of resistance coil.

1,142,866. Electric Current Generator. J. M. Wilson, assignor to Splitdorf Electrical Co., Newark, N. J. Working current controled by contacts operated by field magnet.

1,142,875. Electromegaphone Receiver, Etc. C. K. Cregier, Chicago, Ill. Telephone-receiver diaphragm varies frictional tension device of loud-speaking diaphragm and thereby vibrates same.

1,142,881. Pantograph-Grounding Circuits for Electric Railway Vehicles. E. R. Hill, East Orange, N. J. Has switch in ground connection.

1,142,898. Thermoelectric Ammeter. P. M. Lincoln, Pittsburgh, Pa. Voltage indicated of thermoelectric couple acted on by heat produced by current to be measured.



No. 1,142,835.—Outlet Box for Molding.

1,142,912. Electric Signal. C. M. Saeger, Allentown, Pa. Block system having device for recording signal conditions.

1,142,920. Ignition System for Internal-Combustion Engines. H. R. Van Deventer, Sumter, S. C. Both polarities of alternating current alternately used at igniter.

1,142,935. Support for Electric Trolley Mechanism. F. C. Coseo, assignor to Jeffery Mfg. Co., Columbus, O. Mounting on mining locomotive permits transverse adjustment of pole.

1,142,939. Electrically Heated Oven. R. W. Davenport, assignor to Detroit Stove Works. Construction and location of resister elements.

1,142,964. Adjustable Lamp. F. C. Howe, New Haven, Conn. Secured to plate adjustable over surface of globe.

1,142,973. Electrical Apparatus. J. H. Lehman, New York, N. Y. Igniter vibrator has contacts operated by movable core of induction coil.

1,143,002. Trolley Retriever. F. A. Wasson, Milwaukee, Wis. Air-pressure operated.

1,143,003. Controlling Device for Winding Machines. J. W. West, East Braintree, Mass. Electrically actuated stop-motion device controlled by weight of thread.

1,143,008. Automobile or Train-Lighting System. C. E. Willey, assignor to Jas. Clark, Jr., Electric Co., Louisville, Ky. Structure and speed control of axle-driven generator.

1,143,024. Electrical Signaling Apparatus. D. E. Beatley and P. M. Feltwell, Sewickley, Pa. Automobile signal with electromagnetically operated arm and lamps.

1,143,026. Spark Plug. H. J. Berthold, Irvington, N. J. Particular structure of contacts and insulation.

1,143,041. Current Corrector. N. C. Darby, East Orange, N. J., assignor of one-half to R. Miehling. Rectifier has translating device in parallel with coil whose core intermittently breaks supply circuit.

1,143,050. Flatiron. S. Kako, San Francisco, Cal. Steam electrically generated in iron is discharged through face.

1,143,097. Medicated Mouthpiece-Connector. C. M. Andres, assignor of one-half to A. Soloman, Albany, N. Y. For telephone.

1,143,104. Apparatus for Drawing Glass. W. R. Campbell, Lancaster, O. Glass-drawing bait is electrically reheated after it and attached glass cylinder are removed from drawing apparatus.

1,143,108. Arc Lamp. J. L. Dinsmoor, New York, N. Y. Particular structures of converging-carbon holders and clutches.

1,143,119. Magneto. D. B. Hughes, assignor to Citizens Savings & Trust Co.,

Cleveland, O. Transformer mounted in field.

1,143,140. Telephone-Call Register. J. A. Robinson, assignor of one-fourth to A. J. O'Brien and one-fourth to S. J. Boughton, Denver, Col. Operated by co-operating action of signal-lamp cap and plug.

1,143,144. Mining Machine. F. L. Sessions, assignor to Jeffrey Mfg. Co., Columbus, O. Mounting and arrangement of motor and power connections.

1,143,149. Insulator. L. Steinberger, Brooklyn, N. Y. High-tension insulator clamped in position on supporting rods.

1,143,175. Synchronous Electrical Contact-Maker. F. G. Cottrell and H. A. Burns, assignors to International Precipitation Co., San Francisco, Cal. High-tension rectifier for electrical fume-precipitation system.

1,143,176. Electric System. J. L. Creveling, assignor to Safety Car Heating & Lighting Co., New York, N. Y. Regulation of system with storage battery floated on line.

1,143,181. Dry Cell. M. A. Foos, assignor to National Carbon Co., Cleveland, O. Container structure with guard.

1,143,189. Electromagnetic Sound-Producer. L. Grubman, assignor to Electric Spark Appliance Co., New York, N. Y. Auto horn; electromagnetic vibrator strikes diaphragm.

1,143,190. Automatic Crossing Gate. C. I. Hall, Mount Vernon, Wash. Operated by train-controlled motor.

1,143,191. Electrical System. G. W. Hallock, assignor to the Safety Car Heating & Lighting Co., New York, N. Y. Regulation of car-lighting system having generator and storage battery.

1,143,194. Motor Controller. C. T. Henderson, assignor to Cutler-Hammer Mfg. Co. Controls connections and field strength of series motor.

1,143,195. Vehicle. C. T. Henderson, assignor to Cutler-Hammer Mfg. Co. Electric-automobile duplex controllers have driving seats adjustably guarded.

1,143,201. Electric Talking Sign. L. H. Jones, Wichita, Kans. Desired groups of banks of lamps lighted by motor-driven switching mechanism.

1,143,206. Electric Switch Device and Receptacle. C. J. Klein, assignor to Cutler-Hammer Mfg. Co. Lamp socket having oppositely disposed push-buttons.

1,143,207. Push-Button. C. J. Klein, assignor to Cutler-Hammer Mfg. Co. Extension of push-button plunger permits operation through husk about lamp socket.

1,143,213. Method and Apparatus for Converting Alternating or Pulsating Electric Currents into Unidirectional Currents. R. W. Lohman, Oakland, Cal. Current withdrawn from conductors subjected to rotating electrostatic field or corona.

1,143,220. Electric Welding. R. Mack, assignor to Thomson Electric Welding Co., Lynn, Mass. Machine for forming continuous seam.

1,143,233. Device for Attracting Submarines and the Like. L. Schramm, Jr., Armiger, Md. Powerful electromagnets are secured to ship's sides.

1,143,242. Capping Off Apparatus for Glass Cylinders. E. H. Thompson and J. E. Kajut, assignors to Window Glass Machine Co., Pittsburgh, Pa. Cracking-off wires are electrically heated.

1,143,246. Rain Signal. J. J. Barrash, Chicago, Ill. Electric alarm sounded when rain collects in receptacle.

1,143,264. Electrical Push-Button. C. A. Franck, Yonkers, N. Y. Has insulating housing carrying contacts bridged by metal button sliding in housing.

1,143,270. Automatic Ship's Bell. J. E. Hudson, Batavia, N. Y. Clapper operated by electromagnet.

1,143,279. Table. W. C. Johnson, Cincinnati, O. Has motor-driven, rotary central part.

1,143,290. Illuminator for Cash Registers. N. R. Lippincott, Pittsburgh, Pa. Lamp controlled by drawer lights front.

1,143,305. Transformer. L. C. Nichols, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. Particular corrugated spacing means for coil sections.

1,143,306. Combined Attachment Plug and Base. Mortimer Norden, assignor to J. Norden, New York, N. Y. Plug contacts mechanically secure plug to base and connection is made and broken by twisting plug in base.

1,143,312. Signaling Circuit. W. M. Perry and A. E. Boozer, Columbia, S. C. Circuit arrangements of push-controlled lamps and bells.

1,143,313. Signaling System. W. M. Perry, Columbia, S. C. Circuit arrangements of bell and lamp-call system for hospital.

1,143,322. Outlet Box. M. Robinson, Newton, Mass. Conduits enter bottom of box and are clamped therein by central clamping member pressing outwardly against them.

1,143,327. Vacuum Regulation. H. C. Snook, Cynwyd, Pa., and E. W. Kelly, Philadelphia, Pa. Vacuum control for X-ray tubes.

1,143,340. Watch Stand. E. L. White, assignor to J. H. White Mfg. Co., Brooklyn, N. Y. Dry cell and lamp for illuminating watch face.

1,143,363. Time-Recording Device. C. M. Cook, assignor to Stromberg Electric Co., Chicago, Ill. Time stamp having type wheels electromagnetically operated.

1,143,364. Time Recorder. C. M. Cook, assignor to Stromberg Electric Co. Modification of above.

1,143,367. Call-Registering Mechanism. A. F. Dixon, assignor to Western Electric Co., New York, N. Y. Movement of coin distributer electromagnetically controls register.

1,143,368. Switch Selector. A. F. Dixon, assignor to Western Electric Co. Switches have tripping means, of which selected ones are locked in tripping positions and actuation performed.

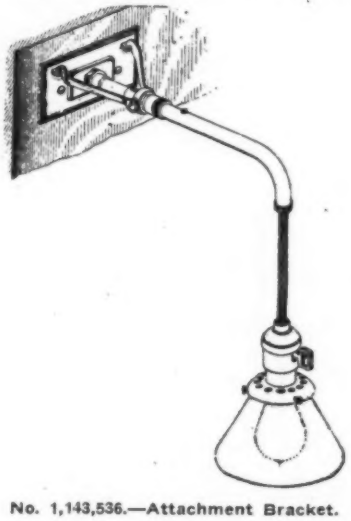
1,143,369. Stop Means for Sheet-Handling Apparatus. P. J. Dreher, Toledo, O. Control for electric driving motor.

1,143,378. Starter and Ignition Control. V. A. Fynn, assignor to Wagner Electric Mfg. Co., St. Louis, Mo. Has engine-starting dynamo-electric machine, a storage battery and means for preventing opening of ignition circuit while battery is connected to dynamo.

1,143,402. Antifrosting Window. W. N. Johnson, Williamsport, Pa. Electric heating elements about edges of pane.

1,143,404. Typewriter. E. E. Kennedy, Neepawa, Manitoba, Can. Platen rotated and carriage returned to initial position by electric motor.

1,143,412. Underground-Conduit Construction. M. H. Loughridge, New York, N. Y. Relates to junction-box construction.



No. 1,143,536.—Attachment Bracket.

1,143,425. Application of Power to Reciprocating-Bed Printing Presses. R. Miehle, assignor to Continental & Commercial Trust & Savings Bank, Chicago, Ill. Motor runs at increasing speed during first part and at decreasing speed during last part of stroke.

1,143,464. Process of Producing Transparent Coatings. E. N. Todd, Millburn, N. J. Electrically produced heat furnishes drying atmosphere for hygroscopic lacquer.

1,143,473. Contrivance for Automatically Detecting the Presence of Certain Gases and Vapors. A. Williams and L. D. Williams, London, England. Conbustible gases detected by exposing pair of thermoelectric elements, one containing a catalytic element and noting voltage.

1,143,485. Battery Connection. C. H. Beck, Altoona, Pa. For securing to wire end to connect with battery terminal.

1,143,487. Microphone and Like Instrument. E. Belin, Paris, France. Variable resistance comprising adjustable contacts connected by resistance and successively bridged by flexible member so no abrupt short-circuit occurs.

1,143,491. Wind Shield. E. P. Bidwell, Monrovia, Cal. Electric heating element at lower side of pane.

1,143,493. Apparatus for Mounting Filaments. L. Dorzychowski, assignor to General Electric Co., Schenectady, N. Y. Securing filaments to supporting arms in incandescent lamps.

1,143,515. Jaw Prop. W. F. Dunlop, New York, N. Y. Carries electric illuminator.

1,143,529. Magnetometer. E. Garretson, Buffalo, N. Y. Permanent magnet with pole pieces and an adjustable magnetic shunt between them.

1,143,530. Electrically Controlled Valve. H. G. Geissinger, assignor to Geissinger Regulator Co., New York, N. Y. Fluid-pressure operated with electromagnetically controlled pilot valve.

1,143,536. Attachment-Plug Fitting. G. W. Goodridge, assignor to The Bryant Electric Co., Bridgeport, Conn. Lamp-supporting extension bracket can be plugged into wall receptacle. (See cut.)

1,143,539. Headlight. C. A. B. Halvorson and L. O. Ingalls, assignors to General Electric Co. Has rear chamber containing operating mechanism to protect from arc fumes.

1,143,568. Electric Water Heater. R. P. Barnstead, Boston, Mass. Heater elements screwed into sockets in container bottom.

1,143,572. Electric Heater. H. W. Denhard, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Flatiron with control switch in handle and thermostatic cutout in body.

1,143,573. Automatic Cutoff for Electrically Heated Devices. H. W. Denhard, assignor to Cutler-Hammer Mfg. Co. Thermostatic switch control for above.

1,143,574 and 1,143,575. Electric Resistance Element. H. W. Denhard, assignor to Cutler-Hammer Mfg. Co. Slotted units for flatirons.

1,143,576 and 1,143,577. Electric Resistance Unit. H. W. Denhard, assignor to Cutler-Hammer Mfg. Co. Different constructions of flatiron elements.

1,143,578 and 1,143,579. Electric Heater. H. W. Denhard, assignor to Cutler-Hammer Mfg. Co. First patent, toaster unit; second patent, curling-iron heater controlled by compartment door.

1,143,583. Belt Gearing. C. F. Hotchkiss, assignor to Stow Mfg. Co., Binghamton, N. Y. Pivoted arm carries flexible shaft and motor and gearing for driving tool.

1,143,586. Process of Producing Chlorates of Alkalis and Alkaline Earths. W. Laib, assignor to Ohio Salt Co., Wadsworth, O. Aqueous solution of chloride of base whose chlorate is to be formed is subjected to electrolysis in cell having graphite anode at low temperature and further electrolyzing at high temperature in cell having platinum anode.

1,143,598. Passenger-Exit Register. C. C. Frum, Clarksburg, W. Va., assignor of one-fourth to J. W. Agnew. Electromagnetically operated.

Patents Expired.

The following United States electrical patents expired on July 5, 1915:

606,646. Rheostat. H. B. Cutter, Philadelphia, Pa.

606,663 and 606,664. Electric Railway. J. C. Henry, Denver, Colo.

606,746. Electric Light Switch. F. L. Temple, St. John, Canada.

606,761. Method of and Apparatus for Generating Alternating Curents. M. Hutin and M. Leblanc, Paris, France.

606,762. Alternating-Current Dynamo. M. Hutin and M. Leblanc.

606,764. Telephone Exchange. F. A. Lundquist, Chicago, Ill.

606,792. Electric Radiator. F. W. Quidas, Mount Washington, Md.

606,795. Electric Meter. W. Stanley, Pittsfield, and F. Darlington, Great Barrington, Mass.

606,803. Telephone System. B. R. Dodge, Post Mill Village, Vt.

606,819. Contact Device for Electrically Propelled Vehicles. H. P. Davis, Pittsburgh, Pa.

606,825. Contact Device for Electric Railways. C. A. Terry, New York, N. Y., and H. P. Davis, Pittsburgh, Pa.

606,826. Current-Collecting Apparatus for Electric Railways. C. A. Terry and H. P. Davis.

606,827. Overhead Construction for Electric Railways. C. A. Terry and H. P. Davis.

606,828. Traveling Contact Device for Electric Railways. G. Westinghouse, Pittsburgh, Pa.

606,830. Insulator. B. Willard, Schenectady, N. Y.

606,852. Telephonic Transmitter. T. F. Ahern, Detroit, Mich.

606,863. Alternating-Current Dynamo. L. Gutmann, Peoria, Ill.

606,884. Electric Snap Switch. A. F. Wood. Philadelphia, Pa.

606,887. Electric Extraction of Poisons. J. B. Campbell, Cincinnati, O.

606,912. Means for Preventing Disturbances in Telephonic Circuits. O. T. Blathy and K. de Kando, Budapest, Hungary.

606,917. Electric Brake. H. P. Davis, Pittsburgh, Pa.

606,939. Switch for Arc Lamps. C. A. Pfluger, Chicago, Ill.

606,990 and 606,991. Electric Railway. J. C. Henry, Denver, Colo.